



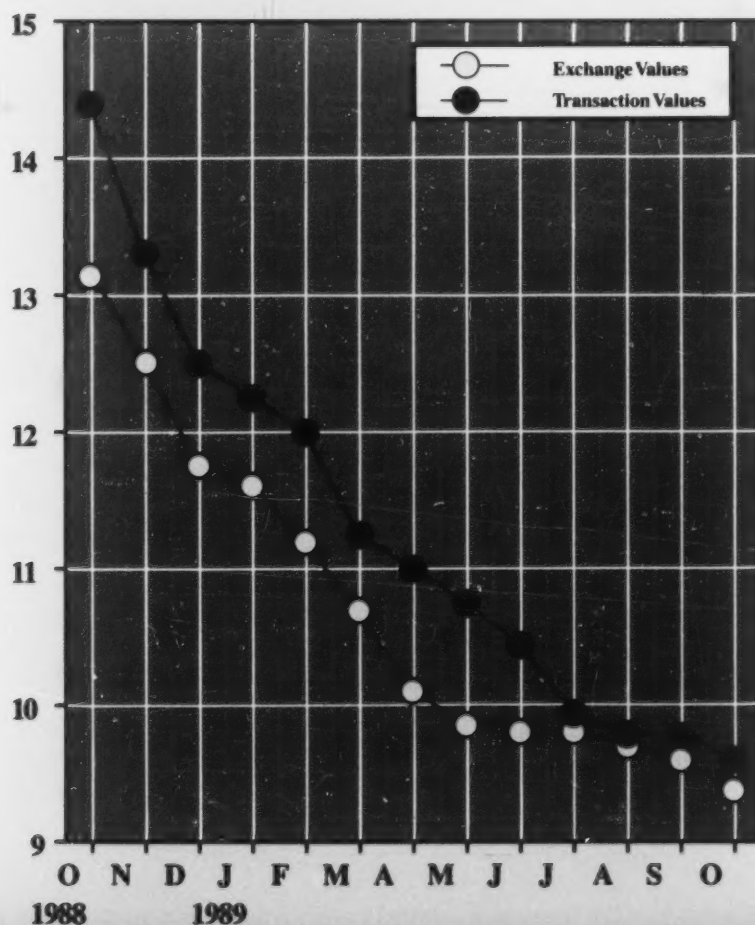
NUEXCO

Monthly Report

November 1989

Number 255

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NUEXCO

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Directory of Nuclear Utilities
(IDNU), International Directory
of Uranium Producers (IDUP)

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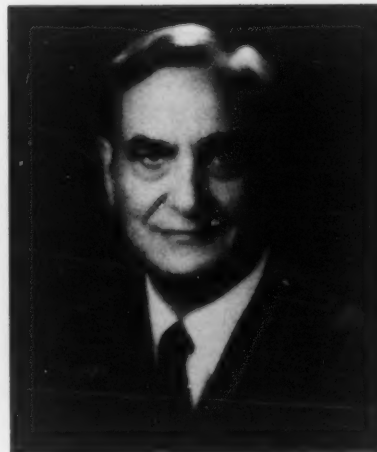
To Our Readers

We are pleased to announce that Mr. Joe Friscia has joined the CONCORD Group and NUEXCO. Joe has been involved in the international power systems business for over 25 years, and has wide experience ranging from power distribution to nuclear power systems and fuel.

After receiving his Master's degree in Nuclear Engineering from Georgia Institute of Technology, Joe joined General Electric's Atomic Power Equipment Department in California. In 1962 he began his international activities with GE in New York as a sales engineer working with European nuclear plant proposals.

From 1967 to 1979, Joe marketed nuclear power plants and fuel in Italy, and was very active in marketing efforts in Switzerland, Spain, Yugoslavia, and South Africa. He became Manager, International Marketing-Europe for GE in 1980, and was responsible for GE's commercial activities with European nuclear clients for the next seven years.

Joe will become active with a number of businesses of the CONCORD Group, including NUEXCO, and will be based in Menlo Park. We welcome Joe to our organization.



PRICING
MARKET VALUES SUMMARY

MARKET VALUES SUMMARY			
October 31, 1989	Market Values	Active Supply ¹ (thousands)	Active Demand ¹ (thousands)
EXCHANGE VALUE ¹	\$9.40/lb U ₃ O ₈	7,880 ²	5,855 ²
UF ₆ VALUE ²	\$28.25/kg U as UF ₆		
LOAN RATE ³	3.5%/annum	7,660	0
CONVERSION VALUE ⁴	\$1.80/lb U as UF ₆	0	270
SWU VALUE ⁵ 0.3 tails assay:	\$59/SWU	1,530	570
TRANSACTION VALUE ⁶	\$/lb. U ₃ O ₈	Millions of Pounds	Number of Transactions
	9.65	2.5	17
			Number of Months
			4

¹Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

²For both uranium concentrates and uranium hexafluoride.

DEFINITIONS

- The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
- The **UF₆ Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
- The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
- The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
- The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.
- The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
 - Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
 - At least ten transactions;
 - Transactions involving a sum total of at least 2 million pounds U₃O₈ equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

- All Market Values are based on:
 - Data from recently completed transactions.
 - Data from pending transactions.
 - Firm bids to buy or borrow, and firm offers to sell or lend.
 - Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
- Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
- In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers.
- The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
- For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
- In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

PRICING

NATURAL URANIUM AND SPOT CONVERSION

(All data as of October 31, 1989)

Increasing supply, competitive offers, and falling prices characterized the nuclear fuel market in October. All NUEXCO market values except for the Loan Rate declined, and the UF₆, Conversion, and SWU Values each fell by more than five percent. Suppliers aggressively pursued all sales opportunities, resulting in three U₃O₈ and three UF₆ sales for near-term delivery. Spot market volume totalled approximately 1.1 million pounds U₃O₈ equivalent. In other segments of the market, two spot conversion sales, two natural uranium loans, and two SWU sales are reported.

The **Exchange Value** declined to **\$9.40** per pound U₃O₈ from \$9.60 last month. Three natural uranium concentrate sales are reported, totalling more than 600 thousand pounds U₃O₈. Two utilities and one intermediary were buyers in these transactions. Most of these parties were US entities, and the majority of the remaining active demand is also accounted for by US buyers. As has been the case for some time, demand is largely discretionary and the active category includes a number of uranium producers.

The earliest October sale took place at a price above the current Exchange Value, while prices for the next two sales were lower and more in line with the current Exchange Value. Several utilities received more than twenty proposals in response to bid requests, and a number of suppliers resubmitted lower-priced offers.

Two additional U₃O₈ sales are included in the Transaction Table on page 6, but neither contributed to this month's spot market volume since they both took place earlier in the year.

The **UF₆ Value** declined five percent this month from \$29.75 to **\$28.25** as sellers suddenly became very

aggressive. In an unusually active month for UF₆, three near-term sales are reported. One purchaser was European, while the other two were US entities. Prices in two of the sales were within two percent of the current UF₆ Value. This month's buying activity clearly reflects a weakened UF₆ market, and perceptions that substantial material is still available for sale continue to spur competition.

Active supply of natural uranium increased by approximately 2.7 million pounds U₃O₈ equivalent to **7.9 million pounds**. **Active demand** was **5.9 million pounds**, up from 4.5 million pounds the previous month. The new **supply/demand ratio** is **1.3 to 1**, slightly higher than last month's ratio of 1.2 to 1.

Should certain large suppliers, such as China, re-enter the market, and if Namibian uranium becomes politically acceptable in the coming months as expected (see article on page 13), active supply could increase substantially.

A surge in buying activity remains more remote, as discretionary buyers dominate the demand side. Many potential buyers have indicated that they are not likely to reenter the market for discretionary purchases until the market shows indications of a price increase.

The **Transaction Value** fell \$0.15 to **\$9.65**. Its calculation includes 17 transactions (six from this month) occurring over four months and totalling approximately 2.5 million pounds U₃O₈ equivalent. The calculation covers a four month period in order to satisfy the requirement that the Transaction Value include at least two million pounds.

The **Loan Rate** is unchanged at **3.5 percent** per annum. One loan transaction involving UF₆ is reported at or near the Loan Rate. Loan supply is down by more than one million pounds from last month.

PRICING

The **Conversion Value** declined from \$1.90 to **\$1.80**, the largest drop in over a year. Two conversion sales are reported, and both took place at or near the Conversion Value. The distinction between the primary and secondary conversion markets continues to diminish in the case of spot opportunities, as primary converters are now competing aggressively with other suppliers for near-term sales. Inventories of EUP are also affecting the conversion market, as conversion is now readily available through deenrichment and deconversion transactions. With little current demand for spot conversion, some suppliers, in order to generate sales, are making unsolicited offers.

ENRICHMENT

The **SWU Value** registered its sharpest drop in two years, falling from \$63 to **\$59** per SWU. Two SWU sales are reported: one involving a small quantity at an undisclosed price for near-term delivery, and another for longer-term delivery.

Several utilities are evaluating SWU offers at or near the current SWU Value, and one US utility is expected to make a decision in early November. This sale is for a substantial quantity of EUP and will likely validate current market levels. The availability of a large quantities of SWU has increased competition, and several buyers have received increasingly attractive offers. ■

NOTICE OF CORRECTION

Please note the following corrections to the Historical Transaction Values section of the Monthly Report, as listed on page 33.

Date	Error	Correction
August 1980	\$31.30	\$31.60
May 1986	\$17.05	\$17.15
May 1989	\$10.80	\$10.75

CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹						
Country (currency)	per lb U ₃ O ₈ as Concentrates			per kg U as Concentrates		
	This Month (Oct 31, 1989)	Last Month (Sept 30, 1989)	12 Months Ago (Oct 31, 1988)	This Month (Oct 31, 1989)	Last Month (Sept 30, 1989)	12 Months Ago (Oct 31, 1988)
Australia (dollar)	12.01	12.42	15.98	31.21	32.30	41.54
Belgium (comm. franc)	362.24	379.30	489.21	941.73	986.09	1,272
Canada (dollar)	11.03	11.33	15.84	28.68	29.47	41.17
EEC (ecu)	8.42	8.77	11.33	21.89	22.80	29.45
Finland (markka)	39.93	41.27	55.32	103.81	107.30	143.82
France (franc)	58.57	61.22	79.65	152.26	159.17	207.07
FRG (mark)	17.25	18.06	23.32	44.84	46.95	60.62
Italy (lira)	12,663	13,149	17,346	32,922	34,184	45,096
Japan (yen)	1,334	1,347	1,653	3,468	3,503	4,296
Netherlands (guilder)	19.47	20.39	26.29	50.61	53.00	68.35
South Africa (rand)	24.73	26.27	32.15	64.29	68.28	83.59
Spain (peseta)	1,098	1,155	1,545	2,855	3,004	4,015
Sweden (krona)	60.22	61.98	81.02	156.55	161.12	210.64
Switzerland (franc)	15.10	15.65	18.93	39.25	40.69	49.21
UK (pound)	5.94	5.96	7.42	15.45	15.48	19.30
US (dollar)	9.40	9.60	13.15	24.44	24.96	34.19

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹						
Country (currency)	per lb U ₃ O ₈ as Concentrates			per kg U as Concentrates		
	This Month (Oct 31, 1989)	Last Month (Sept 30, 1989)	12 Months Ago (Oct 31, 1988)	This Month (Oct 31, 1989)	Last Month (Sept 30, 1989)	12 Months Ago (Oct 31, 1988)
Australia (dollar)	12.32	12.68	17.50	32.04	32.97	45.49
Belgium (comm. franc)	371.87	387.20	535.71	966.78	1,007	1,393
Canada (dollar)	11.32	11.57	17.34	29.44	30.08	45.08
EEC (ecu)	8.64	8.95	12.41	22.47	23.28	32.25
Finland (markka)	40.99	42.13	60.58	106.58	109.53	157.50
France (franc)	60.12	62.50	87.22	156.31	162.49	226.75
FRG (mark)	17.71	18.43	25.53	46.03	47.93	66.38
Italy (lira)	13,000	13,423	18,995	33,797	34,896	49,382
Japan (yen)	1,369	1,375	1,810	3,560	3,576	4,705
Netherlands (guilder)	19.99	20.81	28.79	51.96	54.10	74.84
South Africa (rand)	25.39	26.81	35.21	66.00	69.71	91.53
Spain (peseta)	1,127	1,179	1,691	2,930	3,066	4,397
Sweden (krona)	61.82	63.27	88.72	160.72	164.48	230.66
Switzerland (franc)	15.50	15.98	20.73	40.30	41.54	53.89
UK (pound)	6.10	6.08	8.13	15.86	15.81	21.13
US (dollar)	9.65	9.80	14.40	25.09	25.48	37.44

¹Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹						
Country (currency)	per lb U as UFs			per kg U as UFs		
	This Month (Oct 31, 1989)	Last Month (Sept 30, 1989)	12 Months Ago (Oct 31, 1988)	This Month (Oct 31, 1989)	Last Month (Sept 30, 1989)	12 Months Ago (Oct 31, 1988)
Australia (dollar)	2.30	2.46	2.37	5.07	5.42	5.22
Belgium (comm. franc)	69.36	75.07	72.54	152.92	165.50	159.93
Canada (dollar)	2.11	2.24	2.35	4.66	4.95	5.18
EEC (ecu)	1.61	1.74	1.68	3.55	3.83	3.70
Finland (markka)	7.65	8.17	8.20	16.86	18.01	18.09
France (franc)	11.21	12.12	11.81	24.72	26.71	26.04
FRG (mark)	3.30	3.57	3.46	7.28	7.88	7.62
Italy (lira)	2.425	2.602	2.572	5.346	5.737	5.670
Japan (yen)	255.43	266.67	245.07	563.12	587.90	540.28
Netherlands (guilder)	3.73	4.03	3.90	8.22	8.89	8.59
South Africa (rand)	4.74	5.20	4.77	10.44	11.46	10.51
Spain (peseta)	210.26	228.67	229.03	463.53	504.13	504.93
Sweden (krona)	11.53	12.27	12.01	25.42	27.04	26.49
Switzerland (franc)	2.89	3.10	2.81	6.37	6.83	6.19
UK (pound)	1.14	1.18	1.10	2.51	2.60	2.43
US (dollar)	1.80	1.90	1.95	3.97	4.19	4.30

SWU VALUE AND UF ₆ VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹			
Country (currency)	SWU Value at 0.30% Tails Assay This Month (Oct 31, 1989)	SWU Value at 0.30% Tails Assay Last Month (Sept 30, 1989)	UF ₆ Value per kg U as UF ₆ This Month (Oct 31, 1989)
			UF ₆ Value per kg U as UF ₆ Last Month (Sept 30, 1989)
Australia (dollar)	75.35	81.53	36.07
Belgium (comm. franc)	2,274	2,489	1,089
Canada (dollar)	69.24	74.38	33.15
EEC (ecu)	52.84	57.55	25.29
Finland (markka)	250.64	270.85	120.00
France (franc)	367.60	401.79	176.01
FRG (mark)	108.26	118.51	51.83
Italy (lira)	79,483	86,290	38,057
Japan (yen)	8,372	8,842	4,009
Netherlands (guilder)	122.20	133.78	58.51
South Africa (rand)	155.22	172.37	74.32
Spain (peseta)	6,892	7,582	3,300
Sweden (krona)	377.96	406.71	180.97
Switzerland (franc)	94.76	102.72	45.37
UK (pound)	37.31	39.08	17.86
US (dollar)	59.00	63.00	28.25

¹Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.



CURRENT MARKET DATA

RECENT TRANSACTIONS¹

URANIUM SALES

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U ₃ O ₈ equivalent)	Approximate Price Range ² as Percent of Current Exchange or UF ₆ Value	Seller	Buyer	Remarks
4636	1989	601-1,000	103-107	R ³	Utility	Transaction Occurred Earlier in 1989
4669	1990	101-300	98-102	Intermediary	Utility	UF ₆
4670	1990	101-300	98-102	Intermediary	Utility	UF ₆
4671	1990	50-100	103-107	Intermediary	Intermediary	
4672	1990	301-600	103-107	Intermediary	Utility	UF ₆
4674	1989	101-300	98-102	Intermediary	Intermediary	
4679	1990	101-300	98-102	Intermediary	Utility	
4684	1990-99	1,001-3,000	R ³	Producer	Utility	Transaction Occurred Earlier in 1989. Base Price Escalated

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

CURRENT MARKET DATA

LOAN TRANSACTIONS¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U₃O₈ equivalent)	Approximate Price Range² as Percent of Current Loan Rate	Lender	Borrower	Remarks
4676	1989	101-300	98-102	Utility	Intermediary	UF ₆
CONVERSION SERVICES SPOT MARKET SALES¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U equivalent)	Approximate Price Range² as Percent of Current C.V.	Seller	Buyer	Remarks
4678	1990	101-300	98-102	R ³	Utility	
4683	1990	301-600	103-107	Converter	Utility	
ENRICHMENT SERVICES SECONDARY MARKET SALES¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity⁴ (thousand SWUs)	Approximate Price Range² as Percent of Current SWU Value⁵	Seller	Buyer	Remarks
4675	1992-94	101-300	R ³	Intermediary	Utility	
4681	1990	Less than 50	R ³	Intermediary	R ³	
¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information. ² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range. ³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality. ⁴ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 w/o tails assay. ⁵ Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.						



CURRENT MARKET DATA

URANIUM SUPPLY (October 31, 1989)			
Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
88-1001	250	—	1989
88-1026	150	—	1989
89-1001*	1,300	1,000 per year	1989-90, UF ₆
89-1076	500	250 per year	1990 on
89-1156	200	—	1989
89-1180	1,000	—	1989
89-1188*	400	—	1989
89-1194	100	—	1989-90
89-1200	300	—	1990
89-1201*	2,000	—	1989
89-1209*	400	400 per year	1990-93
89-5000A*	1,280	—	1989, UF ₆
.....			
Total	7,880		
INACTIVE			
88-1081	340	—	1990, UF ₆
89-1029	1,200	300 per year	1989-98
89-1173	1,000	—	1990
.....			
87-1005*	—	250 per year	1990-95
87-1109*	—	350 per year	1990-on
87-1123*	—	1,000 per year	1990-on
88-1157*	—	1,000 per year	1990 on, UF ₆
Total	2,540		
[*] New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 87-1000.			

CURRENT MARKET DATA

URANIUM DEMAND (October 31, 1989)			
Delivery Period¹ (Thousand Pounds of U₃O₈)			
NUEXCO Project Number	Spot or Near-term²	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
89-1068	750	—	1989
89-1133*	1,000	—	1990
89-1142A	800	—	1990, UF ₆ e
89-1164	670	—	1990
89-1175	170	170 per year	1990-91
89-1183	400	—	1990
89-1199	150	—	1990
89-1208*	95	—	1990
89-1210*	700	—	1990
89-1218*	1,000	1,000 per year	1990-93
89-1224*	120	—	1989
.....			
88-1227	—	1,600	1990-95, U ₃ O ₈ /UF ₆
89-1090	—	150 per year	1991-96
89-1172	—	500 per year	1992-on
89-1176	—	600 per year	1991-96
89-1192	—	1,200	1992-97
Total	5,855		
INACTIVE			
89-1067	500	—	1989
89-1163	1,000	—	1990
89-1167	350	350 per year	1990-94
89-1187	325	—	1990, UF ₆
89-1189*	500	—	1989-90
.....			
Total	2,675		
[*] New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 89-1130, 89-1132, 89-1174, 89-1179, 89-1195, 89-1202, 89-1204, 89-1207.			



CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND			
(October 31, 1989)			
Delivery Period ¹			
(Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
87-1167	460	—	UF ₆
88-1182	4,000	—	U ₃ O ₈ /UF ₆
89-1077	500	—	U ₃ O ₈
89-1184	200	—	U ₃ O ₈
89-1186	200	—	U ₃ O ₈
89-1196	1,300	—	UF ₆
89-1206*	300	—	U ₃ O ₈
89-1225*	700	—	U ₃ O ₈
Total	7,660		
INACTIVE			
None reported			
Available to Borrow:			
ACTIVE			
None reported			
INACTIVE			
89-1213*	260	—	U ₃ O ₈
Total	260		
* New or revised since last month.			
¹ Measured from the date of this Report.			
Projects removed since last month: 87-1031.			

CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND (October 31, 1989)			
Delivery Period¹ (Thousand Pounds of U as UF₆)			
NUEXCO Project Number	Within 3 Years	Beyond 3 Years	Remarks
Available for Sale ACTIVE <i>No conversion supply is reported</i>			
Inquiries to Purchase ACTIVE 89-1212* 270 — 1990 Total 270			
INACTIVE <i>None reported</i>			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 89-1197.			



CURRENT MARKET DATA

SWU SUPPLY AND DEMAND (October 31, 1989)			
 NUEXCO Project Number	Spot or Near-term ²	Delivery Period ¹ (Thousand SWUs) Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
88-1082*	25	—	1989
88-1096*	190	—	1990
88-1200	15	—	1989
88-1210*	300	—	1990
89-5000B	1,000	—	1989
Total	1,530		
INACTIVE			
87-1128	360	—	1989
Total	360		
Inquiries to Purchase			
ACTIVE			
88-1236	250	—	1990-94
89-1142B	300	—	1990, UF6e
89-1211*	20	—	1990
88-1061		500	1991-95
89-1203		60	1991
89-1214*		80	1991
Total	570		
INACTIVE			
89-1043	50	—	1990
89-1047		600	1991-95
Total	50		
* New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 89-1118, 89-1135.			

RECENT DEVELOPMENTS

SOUTH AFRICA

Anti-Apartheid Sanctions Update

F.W. de Klerk, South Africa's new president, has avoided further tightening of sanctions against the Republic—at least for the present. Since his National Party's victory in the September 6 Parliamentary elections, De Klerk has already carried out some of his pre-election promises. Seizing the initiative, he suddenly released eight of the nine most prominent political prisoners. Of that group only Nelson Mandela remains in custody, and his release is possible in the near future. By releasing virtually the entire old-guard leadership of the African National Congress (ANC) at once, and by allowing the largest anti-apartheid demonstration in history to take place on October 29, De Klerk has allowed the *de facto* unbanning of the ANC.

Because of such actions and the likelihood of additional concessions to the black majority, the Bush Administration has indicated reluctance to impose further sanctions on South Africa at this time. However, unless De Klerk takes substantive action by June 1990 to end apartheid, the USA may consider stronger measures.

US Senate Committee Hearing

The Administration's views, among others, were presented at the October 3, 1989 Senate Foreign Relations Committee hearing on US policy options towards South Africa. Chairman Claiborne Pell and most of the committee members (Senators Kerry, Simon, Cranston, Sarbanes, Helms, Kassebaum, and Sanford) expressed varying degrees of support for either tightening the sanctions or waiting to see what the new De Klerk government would do.

Senator Kennedy was the lead witness at the hearing, opposing the South African government's apartheid policy, and criticizing the Bush Administration for its lack of support for additional sanctions. Other testimony was presented from a Gallup poll commissioned by the South African Chamber of Mines which indicated that most blacks in South Africa oppose sanctions.

Mr. Herman J. Cohen, Assistant Secretary of State for African Affairs, reported the Bush Administration's wish to give the newly-elected government in South Africa time to demonstrate its good intentions to end apartheid. Mr. Cohen said the Administration's main goal at the moment is to have all parties enter into a dialogue. The Administration intends to monitor the situation, while following these four principles:

- Work toward fundamental political change in South Africa leading to an end to apartheid,
- Fully enforce the Anti-Apartheid Act,
- Support economic development in South Africa and regional economic development,
- Consult with all parties concerned—the South African government, black groups, neighboring countries, US allies, and Congress.

Although the USA has given de Klerk a reprieve from additional sanctions, the full *removal* of sanctions is unlikely until after elections involving all South Africans take place.

Sanctions Against Namibia

Regarding Namibia, Mr. Cohen recommended the removal of economic sanctions against Namibia after the United Nations certifies the November elections, and added that he "is aware of a British-owned uranium mine [Rössing] which will shortly be forced to lay off workers if they can't export uranium." He also noted that the State Department had initially opposed extending sanctions to Namibia, since apartheid is a creation of South Africa, not of the Namibian people.

Although the State Department has issued a letter stating it will lift US sanctions imposed by the Comprehensive Anti-Apartheid Act of 1986 against Namibia once it becomes independent, as a precaution against unanticipated delays in removing these sanctions, the State Department has been preparing language to attach to a bill expected to pass Congress this session. That rider will also reflect the State Department's position that Namibian independence will constitute sufficient justification for lifting of US sanctions.

RECENT DEVELOPMENTS

Commonwealth Nations Discuss Sanctions

Representatives from the 49 Commonwealth nations also discussed sanctions against South Africa in October, and, with the exception of the United Kingdom (UK), all were in favor of harsher punitive measures. Australian Prime Minister Bob Hawke presented a particularly tough plan, which British Prime Minister Margaret Thatcher strongly opposed. The final joint Commonwealth statement represents a compromise of positions in which the Commonwealth's current sanctions against South Africa are to remain in effect.

Although De Klerk must convert his pre-election promises to action within six months in order to avoid stronger Commonwealth measures, these sanctions carry only symbolic significance. Japan, the Federal Republic of Germany, Britain, and the USA are South Africa's important trading partners, and the Commonwealth states in southern Africa will continue trading with South Africa out of economic necessity, regardless of additional Commonwealth sanctions.

Anticipated Political Changes

In the September 6 election, fully 71 percent of the votes were cast against the Conservative Party, whose current policies represented the mainstream of South African political thought as recently as ten to fifteen years ago. This, in connection with the surprising gain shown by the liberal Democratic Party, indicates that the electorate has clearly shifted to the left, and that the climate has improved for political reform. It is now up to De Klerk and the National Party to forestall the escalation of internal conflict and external sanctions. Three concrete moves are widely expected:

- eliminating the banning of all political associations,
- releasing Nelson Mandela, and
- relaxing the three-year-old state of emergency under which civil liberties have been suspended (although pressure to completely remove the state of emergency is expected to mount).

With the world waiting impatiently for substantial political reform, De Klerk now has a unique but short-lived opportunity to promote peace and renewed acceptance of his country. ■

USA

Sundance Conference

On October 20-22, the Institute for Resource Management, the organization founded by actor and environmentalist Robert Redford, sponsored a conference in Sundance, Utah entitled "Should Nuclear Power in the United States be Revitalized?". The primary purpose was to bring together people of various backgrounds and of different opinions to work towards a common viewpoint. The main stimulus for the conference was an earlier meeting in Sundance concerning the greenhouse effect, and the prospect that nuclear could contribute to its solution.

Almost 50 prominent representatives from the nuclear industry, the government, environmentalist organizations, and other energy experts were invited to the conference. As expected, opinions varied widely, although they appeared to fall into three main categories:

- Nuclear power would be needed in the future and advancing the technology and maintaining the option was in the national interest.
- Energy needs could be handled by conservation and improvements in energy efficiency (although there was difficulty in defining "conservation").
- Nuclear power should not proceed under any circumstances since it increases the risk of nuclear proliferation.

The majority of participants felt that the nuclear option would be needed in the future, and that an improved generation of plants was needed to gain public acceptance for later expansion. ABB Atom, Combustion Engineering, General Atomics, General Electric, and Westinghouse discussed their efforts to develop a new generation of smaller, simpler, cheaper, and less operator-dependent reactors.

Howard Allen, Chairman of Southern California Edison, noted the need to address the greenhouse problem, and added that, although his company is experimenting with a number of alternative energy sources and conservation, he saw no alternative to the continued use of nuclear.

Although no consensus emerged from the weekend meeting, a dialogue has clearly been established among industry professionals, and the way prepared for further discussions on nuclear power's future. Perhaps the next meeting should begin where this one left off—assuming that nuclear power is needed, and discussing what will make the nuclear industry acceptable to all and what specific actions can be taken. ■

RECENT DEVELOPMENTS**US High Level Waste Program**

In 1982 Congress passed the Nuclear Waste Policy Act to establish a program for the permanent disposal of high level nuclear waste. Because of continuing opposition to DOE's efforts to select two sites (one in the eastern part and one in the western part of the U.S.) and the expense and time required to look at three sites for each repository, Congress amended the act in 1987 to require investigation of only one site—Yucca Mountain, Nevada. This amended Act also requires DOE to study the need for a monitored retrievable storage facility (MRS) to receive, package, and temporarily store the waste prior to its disposal in the permanent repository. Although Congress had intended to help DOE move forward on site characterization at Yucca Mountain, since 1987 the program has slipped further and further behind schedule.

This summer the NRC issued its Waste Confidence Review confirming that spent fuel can be stored safely in reactor storage pools or at an on-site or off-site independent spent fuel storage facility for at least 30 years beyond the reactor's operational life without any safety or significant environmental impacts. Under the NWA, DOE was scheduled to begin accepting utility waste in 1998 and the repository to open in 2003. The original timetable called for site characterization to begin last spring, with work on construction of the first exploratory shaft to begin in August of this year. Various problems including lawsuits and delays in obtaining the necessary permits from the state of Nevada, have postponed the start of shaft construction until some time next year, assuming it can obtain the necessary licenses and site permits.

The NRC publicly acknowledged what privately has been known in the industry for some time—DOE is now significantly behind schedule. Instead of continuing the unrealistic timetable legislated, the NRC recommends DOE plan for repository operation in "the first quarter of the 21st century" rather than a specific year such as 2007.

Major Problems Facing Waste Program

DOE's high level waste program management is inundated with problems. Having acknowledged it is behind schedule, DOE is confronted with a variety of issues, all of which require more time to resolve. In the meantime, Congress and DOE's clients, the nuclear

utilities, are rapidly running out of patience. Some of the most difficult problems facing DOE include:

- refusal by the State of Nevada to cooperate on any aspect of the program except to take federal government funds to complete its own independent scientific review of DOE's work,
- Congressional cuts in DOE's funding indicating displeasure with DOE's management of the program,
- a lawsuit brought by TRW to prevent the awarding of the "super gorilla" operations and management contract to Bechtel,
- various environmental issues such as the welfare of the desert turtle and pupfish,
- NRC staff concerns with technical issues regarding DOE's site characterization plans, and
- the uncertain status of the MRS which DOE continues to insist is an integral part of the entire waste management program.

Opposition from the State of Nevada

Governor Bob Miller of Nevada held a press conference September 19, 1989 to claim that resolutions passed by the Nevada state legislature with his signature constitute the State's "notice of disapproval". Under the Nuclear Waste Policy Amendments Act of 1987, a state may exercise a veto and refuse to accept the nuclear waste. If Congress does not act to negate the veto within 90 days, an alternative site must be chosen.

The nuclear industry interprets the Act's intent for the state to exercise its veto *after* the site has been characterized and recommended to the President. Since these actions have not been completed yet, the State's veto is premature. This puts DOE in the uncomfortable position of enforcing the law, since the NWA requires DOE to proceed with characterization in Nevada, yet Nevada will not cooperate.

DOE is reviewing three possible courses of action:

- continue negotiations with the state,
- take the state to court to challenge the law, or,
- ask Congress to further amend the NWA to circumvent Nevada's obstructionist tactics.

RECENT DEVELOPMENTS

Cuts in Congressional Funding

Congress has already expressed its dissatisfaction with DOE's management structure and "duplicative or unnecessary contractual arrangements" by cutting the funds appropriated for FY 1990 to \$346 million. This is approximately \$20 million below the current level of spending, but \$154 million less than DOE initially requested. Congress "fenced in" \$6 million of the \$11 million appropriated for the State of Nevada's independent review of DOE's work. These funds can be allocated at the discretion of the Secretary of Energy if Nevada demonstrates good faith efforts to cooperate with DOE.

The conference report for the bill directs DOE to submit a report within 60 days (the end of November) describing how DOE plans to address Congressional concerns about schedule delays, management deficiencies, and lack of integrated contractor efforts. The waste program budget will also be cut (perhaps temporarily) by \$18 million due to Gramm-Rudman.

TRW Lawsuit

DOE lost a major battle in the courts. The US Claims Court ruled that TRW, Inc., an unsuccessful bidder for the \$1 billion management contract for Yucca Mountain, had been injured when DOE awarded the contract to Bechtel Management Systems Inc. DOE is permanently restrained from awarding the contract to anyone other than TRW. The court found that Sam Rouso, the acting director of the Office of Civilian Radioactive Waste Management (OCRWM), violated conflict of interest laws since he was formerly associated with one of Bechtel's subcontractors. DOE announced on October 23 it will appeal the Claims Court decision to "preserve its options".

DOE can now administer the program on its own or with selected contracting. The program is still without a permanent OCRWM Director, and no nomination has yet been submitted for the office, although several potential nominees names have circulated. DOE continues to believe that the court decision will not effect near term activity at the site. Current delays at the site are caused by a problem with quality assurance programs with site contractors and the lack of state environmental permits.

NRC Concerns with Site Characterization

The NRC staff has responded to DOE's draft site characterization plan, and in early August published its recommendations for comment. The NRC's major

concerns remain the lack of a qualified quality assurance program, which is essential before beginning site characterization, and the adequacy of the exploratory shaft design and design control process.

A number of scientific issues are still subject to debate and will only be resolved by proceeding with site characterization. Some of these include:

- volcanism and seismic activity in the area,
- whether the water table could rise enough to flood the repository in the next 10,000 years,
- the lack of integration of the post-closure program (after the repository is sealed) with the waste package performance,
- the adequacy of the integration of the repository design with the SCP and the exploratory shaft design.

DOE has stated, however, that none of the objections are so damaging as to prevent it from continuing with its shaft design and other surface based testing.

The Nuclear Waste Technical Review Board, a Congressionally established independent review body, told the NRC on September 14 that DOE should drill additional exploratory shafts under the repository to study a fault which could make the site unsuitable for a permanent repository. The Board also recommended that DOE's current program is not flexible enough to respond to unexpected findings; DOE may not have an adequate method for assessing the value of scientific experts and; a systematic risk assessment for the repository has not been considered. They are expected to review various technical aspects of the program and report to Congress and DOE before the end of the year.

The NRC has issued a final rule on procedures for implementing the National Environmental Policy Act for the repository. NRC recognizes that DOE has the primary responsibility for evaluating environmental impacts but will determine if adopting DOE's final EIS is practical. Both DOE and NRC are proceeding without the benefit of EPA's final ground water standard with which the repository will have to comply.

DOE Progress

DOE has made some progress in relatively non-controversial areas such as establishing the Licensing Support System (LSS). DOE issued its first transportation report and authorized funds for the University of Nevada to review DOE's data. In addition, it has access to all land required for site characterization work.

RECENT DEVELOPMENTS

The Monitored Retrievable Storage Facility

When Congress passed amendments to the Nuclear Waste Policy Act (NWPA) it created the office of Nuclear Waste Negotiator and extended the deadline for the MRS Review Commission's report on the MRS to November 1, 1989. While acknowledging that an MRS will increase total costs for the waste management system, DOE continues to insist that an MRS is an essential and integral part of the program. Conceptually DOE prefers a facility which initially would receive, inspect, and store spent fuel until it could be shipped to a repository on dedicated trains. At a later stage the MRS could package and or consolidate fuel into disposal containers. However, the amendments to the NWPA impose a number of conditions before DOE may consider an MRS. The MRS Commission must first submit its report, and the MRS site may be chosen only after a repository site is recommended. Construction of the MRS cannot begin until after the NRC has issued a license for construction of the repository. These conditions were deliberate political linkages created by Congress so that an MRS could not become a *de facto* repository.

On November 1, the MRS Review Commission issued its recommendations to DOE on the need for an MRS. At a hearing the following day before the Senate Energy & Natural Resources Committee, the Commission stated that a linked MRS was not appropriate, but then recommended that two additional facilities—a Federal Emergency Storage facility (capacity 2,000 MT) and a User-funded Interim Storage Facility (capacity 5,000 MT)—be built. In addition, it suggested Congress revisit the issue in the year 2000 when perhaps the scientific as well as the political situation may have changed.

The Commission felt a storage facility would be beneficial, but because it can't be built until a repository site is selected, its economic benefit to utilities would be lost. Thus, a facility to handle only spent fuel from utilities without adequate on-site storage in 2006 was deemed essential. Since opponents of an MRS are primarily concerned that it will become a *de facto* repository, the Commission determined that a smaller facility would be more politically palatable. The Senator expressed concern about the lack of discussion in the report on the spent fuel cooling function an MRS would perform, and requested cost comparisons on an MRS, on-site storage at each utility, and additional interim facilities to replace an MRS.

Waste Program Restructuring

On October 17, several Congressmen, including Interior Committee Chairman Morris K. Udall (D-AZ) and Energy & Commerce Committee Chairman John D. Dingell wrote to Secretary Watkins to express "their dismay over the lack of progress on the nuclear waste program." They also expressed their concern that DOE appears to have no plan to address the state's refusal to give DOE the necessary site permits, and indicated they intend to hold oversight hearings in the next few months.

DOE is already rethinking its waste management program. A DOE waste program spokesman indicated a full scale review of the program is underway and that DOE hopes to announce its reorganization plans by the end of November.

Carl Gertz, Yucca Mountain Project Manager, in an internal memo made public, recommended a two-year moratorium on sub-surface tests, but continued surface testing on land controlled by the federal government in an effort to determine if the site is unsuitable and to offer further assurances to the state of DOE's technical credibility.

Conclusion

DOE is expected to announce in mid-November that it will delay opening the repository until 2010. While site characterization work has not begun, \$3 billion has already been spent and utility contributions to the program continue to accumulate. All programmatic decisions, personnel nominations, and technical issues have been put on hold until the reorganization proposal is completed sometime in November.

Sen. Harry Reid, a Democrat from Nevada, recently described DOE as "inept" and "unprofessional" and expressed concern that DOE never puts the public health and safety first. With comments like this, it seems highly unlikely the state will ever willingly accept the repository.

Once Secretary Watkins has improved the "management" of the program, it remains to be seen whether progress can be made in solving America's high level nuclear waste storage problem. ■

RECENT DEVELOPMENTS

WASHINGTON FOCUS

October was a busy month for Congress, and although the Senate continued its work on appropriation bills, Congress was not able to pass a budget in time to prevent Gramm-Rudman from entering into effect on October 16. In addition, the Clean Air Act received expedited attention, and will probably be passed in some form by the end of the year. Both House and Senate subcommittees considered the air toxics section of the bill that includes radionuclides. Unless revised, it would exclude certain categories of pollutants from EPA oversight because they are adequately controlled by other federal laws. In this case it could relieve utilities from dual regulation by both the EPA and the NRC.

In other activity of interest to the nuclear fuel industry, the Senate Foreign Relations Committee held hearings on sanctions against South Africa; the House Science, Space and Technology Energy R&D subcommittee held another hearing on uranium enrichment; and the Department of Commerce released the results of its investigation into whether imports of uranium threaten the US national security; and EPA radionuclide regulations were issued on October 31.

Anti-Apartheid Sanctions Hearing

On October 3 the Senate Foreign Relations Committee held a hearing to take testimony on US policy options towards South Africa. Herman J. Cohen, Assistant Secretary for African Affairs at the State Department, testified that the Administration intends to give the newly-elected South African government until the summer of 1990 to develop a policy toward ending apartheid. The State Department would like the South African government to take the following steps toward ending apartheid: release all political prisoners and allow the return of all exiles; lift the state of emergency; and lift the ban on all political associations. Cohen also indicated a slight shift in government policy toward Namibia. He said Congress should lift economic sanctions against Namibia once the November elections have been certified by the United Nations.

Gramm-Rudman

Congress continued to work on a budget reconciliation bill, but there probably won't be a law before late November. Gramm-Rudman, the law requiring across-the-board cuts of \$16.1 billion on most government spending if Congress has not reduced the deficit below the \$110 billion ceiling, went into effect October 16. These calculations include DOE's uranium enrichment activities. The Office of Management & Budget has used DOE's net revenue of \$1.325 billion—not its budget authority—and applied the 5.3 percent across-the-board reduction to cut back its spending authority by approximately \$70 million. This cut could be reinstated if Congress passes a budget below the ceiling at a later time in the fiscal year. For example, if that happens in December, then DOE would have to reduce its spending for the two months Gramm-Rudman was in effect. If the reduction is permanent, which is possible given the current political posturing in Washington, DOE must allocate the reduced spending across all of its programs. Thus, AVLIS and other programmatic categories within the uranium enrichment budget would be affected proportionately. The \$134 million appropriation for AVLIS, if cut by 5.3 percent, would be reduced by about \$7 million to \$127 million. Currently, it is not clear if DOE would have the discretion to allocate its 5.3 percent of the cut differently in order to spare AVLIS R&D.

The Washington Post reported on November 2 that there is growing sentiment from Republicans in Congress and certain officials in the Administration that a permanent sequester, i.e. making the spending cuts permanent, might be an acceptable alternative to allowing the Democrats to control the budget.

RECENT DEVELOPMENTS***Enrichment Legislation***

Rep. Marilyn Lloyd's (D-TN) subcommittee held a hearing on uranium enrichment legislation on October 19. The committee heard testimony from four witnesses representing the National Taxpayers Union (NTU), the National Association of Regulatory Utility Commissioners (NARUC), the Uranium Producers Association (UPA), and Mr. Harold Seidman, an independent consultant. There is consensus that something needs to be done to allow DOE to compete effectively in the international enrichment market. The witnesses support some form of government corporation, but they do not agree upon other aspects of the legislation, such as the amount of money the corporation should return to the Treasury. The hearing concluded with no indications from Rep. Lloyd on whether she plans to hold additional hearings or begin markup of the bill. Two other House committees—Interior and Energy and Commerce—also must consider the bill before the House of Representatives will vote on any legislation.

National Security Study on Uranium Imports

The Commerce Department announced on October 23 its finding that imports of uranium into the USA pose no threat to national security. The study found that uranium is essential to the USA's national security, but that significant supplies are available either domestically in inventory, from future production, or from reliable imports. The Department also suggests one source of supply could be reprocessing of uranium tails.

Radionuclide Emissions Ruling

Following last minute high-level lobbying at the White House and at the EPA, it appears that the nuclear industry was successful in mitigating the harshest sections of the EPA's proposed rule on radionuclide emissions (see NUEXCO Report No. 250). Although the final language of the rule is not publicly available yet, industry sources indicate cautious optimism about the new regulation's effect on the nuclear industry.

The standard for emissions has been lowered from 25 mrem/year to 10 mrem/year effective dose equivalent—still a value most of the industry can tolerate. In a briefing given on November 1, the EPA admitted that 7 of the 15 operating underground uranium mines would be effected by this rule and thought that 5 might go out of business. In addition, it has granted a three-month stay of a portion of the rule affecting fuel cycle facilities because of its potential affect on some medical facilities' ability to use nuclear medicine. The EPA also said it will reconsider ways to reduce the regulatory burden of dual regulation of these facilities by both the EPA and the NRC. It is unclear whether "these facilities" include all facilities regulated by the NRC, or just the radiopharmaceutical companies. However, as long as this ambiguity exists, the nuclear industry can continue to challenge the scientific merits of EPA's criteria, and perhaps to prevail.

Questions still remain on the exact nature of the new radon source criteria implementation and on certain requirements for tailings cleanup operations, but these will be answered once the final rule becomes public. The American Mining Congress plans to file suit against the EPA over these new standards, and it is possible the industry will seek relief through legislation. The EPA received over 250 comments, many objecting that the proposed rule was based on outdated scientific rationale. ■

RECENT DEVELOPMENTS

	Nuclear Fuel Industry Developments
<u>OCTOBER</u>	13 Freeport-Uranium Recovery Co. became the latest US producer to announce a shutdown of its uranium operations, and will place its Sunshine Bridge mine on standby until the market improves. Sunshine Bridge has produced about 400,000 pounds annually from by-product operations. 16 Gramm-Rudman, the law designed to reduce government spending if the federal deficit has not been reduced to \$110 billion, went into effect. 18 Following a year-long study on the nation's nuclear industry, the French government reaffirmed its commitment to nuclear power while announcing plans to reevaluate some of its policies. 19 Repp. Marilyn Lloyd's Science, Space & Technology Subcommittee held its second hearing on uranium enrichment restructuring (HR 2480). Additional hearings may take place later this year. 23 The US Department of Commerce study on the potential threat to national security of uranium imports concluded that sufficient supplies exist to meet requirements during a national emergency. Section 232 of the Atomic Energy Act requires this study when imports exceed 37.5 percent of actual US uranium requirements for two consecutive years. 24 An NRC spokesman said the agency planned to extend the operating lives of nuclear plants to 50 or 60 years. Although the Atomic Energy Act only allows 40-year licenses, there are no restrictions on extensions. 27 Rio Algom Mining Corp., the US subsidiary of Canada's Rio Algom Ltd., signed a letter of intent to purchase all the outstanding stock of Uranium Resources, Inc. (URI) for \$66 million. The agreement is non-binding, however, and Denison Mines Ltd. is also reported to have made an offer to URI. Following approval of Seabrook's emergency evacuation plan, the NRC staff recommended the Atomic Safety Licensing Board approve a full power license for the plant. The ASLB is expected to announce its recommendation to the NRC Commission by November 31.

INTERVIEW WITH MR. BORIS V. NIKIPELOV

First Deputy Minister of the Ministry of Atomic Energy And Industry In The USSR

Techsnabexport's (TSE) increasing role in the nuclear fuel market has generated tremendous interest among market participants, especially in these times of glasnost and perestroika. In recent months, various Soviet officials have participated for the first time in several nuclear fuel industry conferences, discussing technical and commercial issues with unprecedented openness. Many previously unknown or misunderstood facts about Soviet nuclear fuel cycle activities have come to light. For example:

■ Although the Soviet Union began uranium enrichment in 1949 using gaseous diffusion, it actually pioneered the development of centrifuge technology, building its first pilot centrifuge plant in 1952. Full-scale industrial centrifuge operations began in 1959. (See NUEXCO's September Report, #253, page 15.)

■ The USSR has a total centrifuge enrichment capacity of over ten million SWU per year, produced by modular facilities, each of which can produce about ten percent of the total.

■ Although the Soviet centrifuge technology was originally developed for weapons production, it is now being used to furnish enrichment services for the commercial (civilian) nuclear power market. TSE handles all export sales on behalf of the Ministry of Atomic Energy and Industry.

■ In recent years, TSE has offered spot contracts as well as near-term enrichment contracts (one to three years in length) to international customers. And TSE has been offering enriched product for sale since 1988.

NUEXCO recently had the opportunity to interview **Mr. Boris V. Nikipelov, First Deputy Minister of the Ministry of Atomic Energy and Industry (MAEI)**, on the subject of TSE and its growing commercial presence in the international nuclear fuel market. Following are some excerpts from that interview.

NUEXCO: Mr. Nikipelov, what is the relationship between Techsnabexport and your ministry?

MR. NIKIPELOV: The Ministry for Atomic Energy and Industry was established in 1989 by combining two Ministries: Atomic Energy and Medium Machine Building. The Ministry's primary mission is the building and operation of the commercial nuclear fuel cycle, from power stations to exploration, mining, milling and uranium recovery, conversion to UF₆, enrichment, fuel fabrication, spent fuel storage, reprocessing, and waste disposal. TSE, a foreign trade organization within MAEI, is most well known for its role in support of the Ministry's primary

mission—the promotion of international trade in the goods and services associated with the *civilian* nuclear power business. But TSE's role goes far beyond nuclear power. It also represents the various industrial and research organizations of MAEI in their import-export activities.

— — — — —
NUEXCO: And what are MAEI's other activities?

MR. NIKIPELOV: In addition to the nuclear fuel cycle, the Ministry is responsible for nuclear instruments, including those used for medical research and radiation therapy. MAEI is responsible for fundamental research

INTERVIEW

into nuclear physics, especially fusion and reactor safety, accelerator technology, and laser technology.

The Ministry also controls the production and marketing of alloying metals and non-metals, such as zirconium, beryllium, molybdenum, tantalum, rare earth elements, fluorine, and others which are used in the fuel cycle. Given its primary need to supply the fuel cycle, the Ministry also manufactures secondary products from these other raw materials. And in accordance with our nation's latest five-year economic plan, whose top priority is to improve availability of consumer goods, the Ministry has also acquired responsibility for development of the capability to manufacture dairy equipment and for the production of a number of durable consumer goods, such as videocassette recorders and other consumer electronics.

Thus, while TSE is known primarily for its sales of enriched uranium and SWU, its commercial officials also sell medical instruments, accelerators, lasers, rare earths, alloying elements, and related products.

NUEXCO: Although the Soviet Union made its first SWU deals with certain Western European utilities in 1973, TSE is unfamiliar to many utility fuel buyers. How would you respond to their concerns about the reliability of TSE as a supplier for their nuclear power plants?

MR. NIKIPELOV: Most importantly, we sincerely aim at open and mutually beneficial cooperation with our customers, whether in the nuclear fuel cycle or in our other activities. In particular, the history of TSE provides abundant evidence of our supply reliability, and we aim to maintain that record.

We recognize, however, that some potential customers may have some concern as a result of lack of information about the Soviet Union's nuclear fuel cycle capabilities. That is one important reason for our willingness to provide much more information than in the past.

We have over 15 years experience in the international nuclear fuel market, having concluded our first transactions in 1973. All of our customers since that time can attest to our on-time performance and that our product has always met quality standards. Several factors have contributed to our record of reliability:

- large enrichment capacity,
- high standards of technology and equipment,

- high degree of operating flexibility available from the use of centrifuge technology.

We would be happy to provide any of our prospective customers with any data necessary to confirm the reliability of our production and the quality of our technology, which exceeds world standards in many aspects. For example, our centrifuges can operate continuously for 15 years with a fault rate of only a few tenths of one percent per annum.

NUEXCO: That speaks well for the Soviet Union's product reliability and quality, but what about TSE's commercial reliability; that is, its reliability as a longer-term contract partner?

MR. NIKIPELOV: In addition to our large production capacity, our extensive long-term experience, and our well-developed technology, adding export sales to domestic demand makes for more stable operation of our facilities, so that factor is also taken into account. Gas centrifuges require low working inventories of UF₆, enabling a high degree of operating flexibility, such as when a customer wants to revise the final product or tails assay.

Customers find that TSE and the Ministry offer substantial flexibility in timing and quantity of deliveries. We are certainly sympathetic to a customer's need to adjust the terms of an existing contract, and will keep in mind the value of the long-term relationship as we work toward a mutually agreeable solution.

NUEXCO: You mentioned "well-developed technology" and "low working inventories", Mr. Nikipelov. What can you tell us about TSE's production costs?

MR. NIKIPELOV: A number of factors give us a substantial cost advantage over other suppliers. We are confident we can demonstrate that our plants produce separative work units (SWU) at substantially lower costs than in Western Europe and the USA, especially by comparison to the gaseous diffusion method.

The centrifuge cascade contains about ten consecutive stages (but not as many as 1,000 stages, as might be the case for a diffusion plant), and each cascade has a large number of connected gaseous centrifuges. Each plant is

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built under a plan so that it will be near to the ideal cascade—i.e., almost without any losses of separative work—and it also makes the cost lower. Thus, the low specific energy consumption of our centrifuge units (three to five percent of amounts consumed by diffusion cascades) and the efficiencies associated with more flexible sizing, give our centrifuge facilities a major advantage over competitors such as DOE and Eurodif. Finally, the low failure rate and an automated operating system associated with centrifuge technology give TSE another cost advantage over diffusion suppliers.

Regarding our cost advantage relative to other centrifuge suppliers, it is well known that in our country the electricity cost and wages are lower than in developed Western countries. It certainly reduces the production costs in comparison with the costs in the West. A continual research and development effort also contributes to cost reductions. Thus, TSE is able to offer highly competitive pricing, as a direct result of being the low-cost competitor in the market.

NUEXCO: Given your competitive advantage as the lowest-cost supplier of SWU and enriched product, what market penetration do you plan to achieve? And what tactics do you intend to use?

MR. NIKIPELOV: We estimate that annual SWU demand of market economy countries will grow to about 38 million SWU by 1995. Our current annual sales of about two million SWU fill only about five percent of that demand. We have sufficient centrifuge capacity to supply more than 25 percent (ten million SWU per year), but only about half that amount is presently reserved for export. Sales of five million SWU per annum would give us about one-eighth of the market.

Our country desperately needs foreign exchange to enable us to play a role in the world economy, so our strategy is calculated to obtain maximum hard currency. Our production capacity is flexible and market demand is relatively inflexible, so some prospective customers may fear that we would engage in predatory pricing (or "dumping") in order to maximize market share. Those fears ignore several points:

■ A dumping strategy is based on raising prices after the key competitors have been driven out of the market. Our economy needs foreign exchange *now*, and we would not

be willing to defer profits long enough to use such a strategy.

■ Furthermore, other suppliers would be very hard to drive out of the market. Their capital investments have already been made, and they would be highly unlikely to withdraw as a result of a price war. Strategic factors would also keep competitors in the market, so any dumping campaign would be longer and more costly than we could accept.

■ Finally, dumping is prohibited by the General Agreement on Tariffs and Trade (GATT), an international trade treaty to which the Soviet Union adheres.

Thus, we intend to continue competing aggressively to sell all of our available output, but without sacrificing favorable prices. We also intend to become more open to presenting information about the quality of Soviet products and services.

NUEXCO: Does that mean you will be limited to long-term contracts?

MR. NIKIPELOV: No. Originally TSE made only long-term SWU contracts, with prices pegged to the DOE price. Over the past several years, as the SWU market has changed, so have we. We still prefer long-term contracts, but TSE has also been offering spot contracts and short-term contracts (one to three years in length).

Since 1988, we have also been offering enriched uranium made from Soviet feed material, and several transactions have already been executed. We are prepared for any or all of our expected four to five million SWU annual sales to be contained in Soviet enriched uranium.

NUEXCO: Mr. Nikipelov, you mentioned your country's need for hard currency to participate in the world economy. How are the funds generated by TSE used? And are they controlled by MAEL, by TSE, or by some other part of the Soviet government?

MR. NIKIPELOV: First, these funds are not going to be used for military purposes of any kind. Second, they will not be used for the development of nuclear power stations of any kind. These funds can be used for improving reactor safety, but that is a concern of all nations, not just of the nations in which power reactors are located.

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The hard currency generated by TSE will be used for three main purposes:

- the purchase of technology and equipment for production, processing, and packaging of milk and milk products,
- the purchase of durable consumer goods (not food-stuffs or grain), and equipment for the manufacture of consumer goods,
- the purchase of equipment and technology for the USSR manufacture of *personal* computers (not for military use).

Part of the funds will be used to cover the Soviet Union's participation in related joint ventures for USSR production. And other purchases will be made through barter transactions, so the buyers of TSE products and services will be able to see the purpose to which the currency is applied. Depending on the volume of hard currency generated by TSE, part of the foreign exchange earnings may be used for the purchase of technology and equipment for the reduction and processing of industrial pollutants and waste products.

NUEXCO: What other products and services can TSE sell?

MR. NIKIPELOV: We are engaged in many other activities, such as sales of:

- natural uranium and other nuclear fuel components,
- equipment using radioisotopes, plus the radioisotopes themselves (Co-60, Cs-137, Pu-238, Np-237) and products using tritium,
- stable isotopes,
- instruments and measuring equipment,
- accelerators, lasers, and associated equipment,
- beryllium and beryllium ceramics,
- zirconium,

- lithium,
- scandium,
- rare earths,
- molybdenum,
- nitrates and phosphates for fertilizers, and
- emeralds and colored stones.

I hope we will be able to cover those other areas in depth at some time in the near future.

We will also aim to establish joint ventures with foreign manufacturers, preferably based on our technology and located in the USSR. We will strive to increase trade volume in general, as trade is a motive force for progress, and a stimulus for peace.

NUEXCO: In conclusion, is there any message you would like NUEXCO's readers to pass on to their colleagues?

MR. NIKIPELOV: Yes. Substantial increases in trade between my country and each of your readers are highly beneficial in promoting peace, and that is even more important than the very real economic benefit to be gained. However, one considerable obstacle to this process is the comparatively low demand in Western countries for products of the Soviet Union. All of TSE's products and services are not yet well known to Western buyers, so that presents another obstacle to trade.

Those factors are especially acute relative to the US market, but we believe TSE's sales into the US market have already begun to stimulate improvements in bilateral trade relations. They also have the potential in the future for expanding those relations further. Considering the possible benefits to world peace, we look forward eagerly to helping to strengthen existing trade bonds between our country and those of your readers, especially the USA. ■

THE EURATOM SUPPLY AGENCY

With the coming liberalization of trade and industry within the European Community (EC) and a more centrally-coordinated EC external trade policy, it is timely to ask if in the 1990s there will be any significant changes in the commercial relations between the EC and non-EC companies trading in nuclear fuel. The key vehicle for implementing any change of policy would probably be the European Atomic Energy Community (EURATOM) Supply Agency in Brussels, which is charged under the EURATOM Treaty with overseeing the equitable supply of nuclear fuel to and among EC companies. The EURATOM Supply Agency (the Agency) is a signatory to almost all EC-company contracts for transactions that occur on the territory of the Community, which includes Belgium, Denmark, France, the Federal Republic of Germany (FRG), Great Britain, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain.

During the 1980s, the Supply Agency has rarely tried to influence the commercial decisions of EC member companies. The nuclear fuel industry has largely perceived the Agency as an administrative office that registers contracts and maintains relations with some outside governments, particularly Australia, Canada, and the USA. However, in 1988 the Agency began to have a more direct commercial impact when it reviewed the practice—previously conducted routinely by the EURATOM Safeguards Directorate in Luxembourg at the request of EC-member companies—of swapping safeguards obligations on equivalent quantities of uranium at different locations (flag swapping).

The Agency's actions inhibiting flag swaps, as well as a related *de facto* policy restricting material swaps of Southern African uranium, caused it to be viewed as obstructive by some EC companies. Some even described the Supply Agency's policies as anti-European in the sense that such swaps promote the fungibility of uranium within the EC's internal market.

During 1989 the discussion about flag swaps and swaps involving South African and Namibian uranium has subsided, and a far-reaching discussion has arisen about EC trade policy in general. As the European Commission in Brussels gains greater authority and the relative authority of the member states diminishes, seemingly an irreversible process, the Supply Agency's influence over the contracting practices of EC companies could grow.

Influence of Politics

The European Commission is the executive body of the EC, composed of seventeen commissioners appointed by the member states, two each from the five largest member states and one each from the seven remaining members. Each Commissioner has the responsibility for a separate portfolio or set of portfolios, such as Energy or Agriculture. Reporting directly to the Commissioners are 22 Director Generals, the most senior civil servants in the EC bureaucracy. Most of the director-generalships in the EC are comparable to ministries in a member state government, and in that sense the EURATOM Supply Agency is unique: with a staff of only twenty-five persons, it is the smallest administrative unit in the EC bureaucracy to have a director-generalship.

The Director General of the Supply Agency is Michael Goppel of the FRG, and he reports directly to the Commissioner responsible for Energy, Antonio Cardoso e Cunha of Portugal. Both Cardoso and Goppel assumed their positions January 1, 1989. The senior administrator of the Supply Agency under Goppel is Jean-Claude Blanquart, from France. An Advisory Committee, comprising officials from EC companies, assists the Supply Agency on a consultative basis.

As the Commission is a political body responsive to the European Parliament, and the Supply Agency is closely

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connected to the Commission, the Agency's rules may be heavily influenced by European politics at any point in time. For instance, the Agency attributes the 1988 *de facto* policy restricting swaps to directives from the Commission. The Commissioner for Energy at that time, Nicolas Mosar of Luxembourg, was a socialist with little enthusiasm for the nuclear sector. He apparently faced a barrage of questions from members of the European Parliament after the publication in the German news magazine *Der Spiegel* of allegations that the Supply Agency had acted wrongly in consenting to flag swaps and allowing free trade in South African uranium. After several meetings with Mosar, the Agency succumbed to the political pressure and changed its guidelines for swaps and for contract review in general. (The letters shown at the end of this article demonstrate the Commission's current position on these and related issues.)

At the moment, the political balance on the Commission tends to favor the nuclear fuel industry. With the appointment of Cardoso and Goppel and the passing of the *Der Spiegel* affair, the Supply Agency has resumed its customary attitude of *laissez faire* with regard to the commercial practices of EC companies. However, the recent experience of political interference suggests that market participants should be aware of changes in the political balance on the Commission, and of changes in the EC's attitudes towards external supplier nations.

Legal Limitations

Under the EURATOM Treaty, which was signed in Rome on March 25, 1957 by the member states of the organization then known as the European Community for Coal and Steel, the Supply Agency has broad legal powers, including:

- the exclusive right, with few exceptions, to conclude contracts involving natural and enriched uranium where deliveries ultimately occur on EC territory;
- the option to purchase material in place of a potential contractual party, which option may be used to enforce the principle of "equal access" of all EC companies to limited supplies;
- the legal ownership (on behalf of the Community) of all special fissile materials—including uranium in most forms other than ore and ore concentrates—produced or imported by EC companies.

Customarily, the Supply Agency's exclusive right to conclude contracts is maintained through provision of a clause in EC-based contracts, after signature of the main parties to the agreement, which reads, "This Agreement is concluded with the concurrence of the EURATOM Supply Agency," and is followed by the signature of an Agency official. The Agency's involvement in the contract normally does not extend past providing such concurrence, and the Agency does not physically monitor uranium stocks. Under the EURATOM Treaty, physical inspection and the accounting of safeguards obligations are the responsibility of the EURATOM Safeguards Directorate. Facilities on EC territory that store and process uranium are required to provide a regular material accounting to the Safeguards Directorate, and EURATOM inspectors check nuclear fuel shipments in and out of the EC. Materials used for national defense purposes in France and the UK are exempt from the regulation.

Since the emergence of the commercial uranium market in the 1970s, the Supply Agency is not known to have exercised its authority to buy and sell on its own initiative, or to rearrange supplies among EC member companies to any notable degree. An unusual situation, however, exists in the relationship between EURATOM and the US Department of Energy (DOE). The Supply Agency is the contract holder and administrator of all EC-company business with DOE, which means that notices to and from EC companies pass through Brussels en route to and from DOE. The Agency has intervened to influence the disposition of some quantities of DOE-origin high-enriched uranium (HEU), as HEU is relatively scarce for EC research programs. However, it is not clear, even in those cases, that the Agency refused to endorse a fully executed contract or exercised its option to purchase in a contemplated sale from an EC company to a non-EC company.

Under the Treaty, if an EC company disagrees with a decision made by the Supply Agency it cannot resort to proceedings in a court of law, but may appeal directly to the Commission, and the Commission must respond within one month of the appeal. While no cases of such appeal are publicly known, an informal appeal was made recently in a case involving a material swap contract that the Agency was slow to endorse. In that case, a major EC company appealed through its national government to a member of the European Commission who caused the Agency to expedite conclusion of the contract.

There are other implicit limitations on the Supply Agency, including the possibility that EC companies might disregard EURATOM's authority. The Agency does not have powers of enforcement. Thus, if the Agency were to discover that a transaction occurred without its concurrence, the Agency's only clear recourse, aside from legal action in the European Court, would be to withhold consent to a future transaction involving the material in question. Because of this limitation, the Supply Agency may make a special effort not to antagonize EC companies or interfere in their affairs. Certain member states, particularly those that might not clearly benefit from the Supply Agency's powers, would be likely to resist any heavy-handedness on its part.

Safeguards Codes

One of the Agency's activities is the maintenance of relations with foreign supplier governments with whom the EC has bilateral safeguards agreements, the principal ones being Australia, Canada, and the USA. The three major EURATOM bilaterals allow for material to be delivered from the source countries to the EC and retransferred freely within the EC, except for in Spain. Spain has its own bilateral agreement with the USA, which the US government is reluctant to renegotiate for the benefit of EURATOM; negotiations are underway for Canada and Australia to accept Spain under the EURATOM bilaterals, but there has been some delay due to Spain's failure to sign the Nuclear non-Proliferation Treaty.

Under the three EURATOM bilaterals, transfers out of the EC of material bearing Australian, Canadian, or US safeguards obligations generally require the prior consent of the relevant governments, which the Supply Agency obtains through established inter-government channels. Reprocessing of fuel also may require prior consent, and has been a topic of discussion between EURATOM and the three governments, who in the past have shown some hesitation in consenting to the separation of plutonium and its use in commercial fuel assemblies.

The EURATOM Safeguards Directorate and the Supply Agency employ a letter-code system to identify the safeguards obligations associated with nuclear fuel located on the territory of the EC. The principal codes are as follows:

Code	Nature of Safeguards Obligation
S	EURATOM-Australia bilateral
C	EURATOM-Canada bilateral
A	EURATOM-USA bilateral
D	EURATOM-USA/EURATOM-Canada bilaterals
T	EURATOM-USA/EURATOM-Australia bilaterals
P	Peaceful uses only
N	No obligations external to the EC

Most of the nuclear fuel facilities in the EC record material on their books on the basis of safeguards codes as opposed to origin, although during the past two years the Supply Agency, and other entities in some cases, have requested statements of origin in addition to safeguards code. In the USA the reverse is generally true, as origins are recorded on NRC forms while safeguards obligations *per se* are not. One of the issues surrounding the question of swaps within the EC was whether in the conduct of a flag swap the "origin" of material followed the "flag" or safeguards code, particularly when material at issue was destined for the USA. Of course, because uranium has identical characteristics regardless of origin, and nuclear fuel facilities keep running stockpiles, the mine origin of uranium cannot actually be traced once it enters the conversion process. The Supply Agency considers uranium that has been substantially transformed within the EC to be of European (or, for example French or British) origin.

Under informal agreements between EURATOM and the Republic of South Africa and EURATOM and the USSR, EURATOM may respect those suppliers' requests for a guarantee by certain end-users of exclusively peaceful use. Material so obligated receives the code P upon entry into the EC. All other material delivered into the EC, where no arrangement exists between EURATOM and the supplier state, receives the code N. Material coded N is considered the most desirable to EC companies because it is subject only to the internal EURATOM safeguards and the agreements between EURATOM and the IAEA.

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Diversity of Supplies

The Supply Agency publishes an Annual Report containing statistics on the number and type of contracts concluded by the Agency and other information about uranium deliveries to and from the EC in the previous calendar year. (See page 37 for a summary of some Agency statistics.) The lead paragraph of the latest Supply Agency's Annual Report reads:

The Supply Agency is able to report that in 1988 supplies of natural uranium and enrichment services to users in the Community were maintained satisfactorily, as were supplies of fuel cycle services. In the natural uranium sector most transactions were spot or exchange operations. Particularly noticeable was the lack of long-term activity and the much lower tonnage purchased than in previous years. This appears to be the consequence of excess inventories held by utilities, which in turn has led to weakness in demand and a falling price in the spot market.

In keeping with the Agency's policy of confidentiality, the Report does not provide statistics on the origins of material or the quantities delivered to particular member states or companies.

In its oversight capacity, however, the Supply Agency monitors the quantities of material imported from various supplier nations. Furthermore, it is clear that persons within the Agency have particular views as to the proper balance of supply sources for the EC, although no official target limits have been published. For whatever reasons—political, strategic or economic—the Agency

may not wish to see the Community supplied with "too much" uranium from a particular source.

One representative of the Agency remarked, after passage of the Anti-Apartheid Act in the USA, that the law must not lead to the EC becoming a "dumping ground" of material of origins not acceptable in the USA. Such a remark is interesting from a purely business perspective, as in theory the Agency should be satisfied at the prospect of additional supplies available to European consumers, as long as the EC has not invoked similar sanctions against South Africa.

At the moment the nuclear fuel market is undergoing its second phase of globalization, with the Centrally Planned Economy (CPE) countries rapidly expanding their place as suppliers worldwide. Much of the CPE uranium has been and will be marketed in Europe. At the same time, Namibian uranium, which has been politically unattractive to European utilities for at least the past two years, could become desirable after that country's independence. How the Supply Agency and the European Commission respond to these and other developments will be interesting to observe.

On the one hand, the EC may be subjected to lobbying by such traditional trading partners as the USA and Canada to limit trade with some of the newer supplier countries. On the other hand, Western Europeans may wish to have fuller trade relations with Eastern Europe, in particular, as well as Asia and Africa. As the EC continues to unify and define its own best interests, these possibilities become more intriguing. ■

Jim Lightner
NUEXCO Trading Corporation

* * *

On the following page are translations of two letters from early 1989 addressed by members of the European Parliament to the European Commission concerning the issues of nuclear fuel safeguards obligations, flag swaps, and origin. Following the letters are the responses of Mr. Cardoso e Cunha, the Commissioner who oversees the Supply Agency. These letters provide some insight into the political environment in which the Supply Agency, by extension, functions. The letters and responses are extracts from the Official Journal of the European Communities, number C270/16 of October 23, 1989.

WRITTEN QUESTION No. 2025/88
by Mrs. Barbara Simons (S)
to the Commission of the European Communities
(25 January 1989)
(89/C 270/28)

Subject: Changes in the declaration of origin of uranium

The Commission states in answer to my Written Question No. 2918/87* that it agrees with the conclusions of Mr. Schmid's report, which was submitted to Parliament in July 1988.

Would the Commission also give precise answers to the following questions:

1. Does the Commission therefore agree that there is a need to alter the legal basis for the practice of flag swaps?
2. Is the Commission taking or contemplating measures to achieve this end and what are they?
3. How will the Commission ensure that political embargos against South Africa are not circumvented by flag swaps in the future?

* OJ No C 114, 8. 5. 89, p.14.

Answer given by Mr. Cardoso e Cunha
on behalf of the Commission
(20 March 1989)

In its presentation to the European Parliament on 26 October 1988**, the Commission confirmed the existence of legal bases for flag swaps at both internal and international levels, even in the absence of specific provisions in the regulations implementing Chapter VII of the Euratom Treaty***.

Moreover, the Commission confirms that it had begun to examine in detail the suitability of explaining in detail the abovementioned regulation with regard to flag swaps as recommended by the Parliament in its resolution on the results obtained by the Committee of Enquiry on the handling and transport of nuclear materials.

At the current stage of the proceedings, the Commission has not identified any decisive reasons, at either the operational or legal-certainty level, for taking such a step.

As stated by the Commission before the Committee of Enquiry on 26 April 1988 flag swaps only affect safeguard systems that apply to the materials at issue, without any repercussions on their origin, since this is a concept that is completely beyond the bounds of inspection. By their very nature flag swaps could therefore not be used to oppose political embargo decisions which might effect materials originating in South Africa.

** Debates of the European Parliament No. 2-370
(October 1988).

***OJ No L363, 31. 12. 76, p.1.

WRITTEN QUESTION No. 2076/88
by Mr. Llewellyn Smith (S)
to the Commission of the European Communities
(27 January 1989)
(89/C 270/32)

Subject: Energy

Pursuant to the EC reply to EP Question 2934/87* on 21 September 1988 to myself, will the Commission (a) explain why the Euratom safeguards directorate is not required to know the origin of safeguarded materials, (b) how does this non-requirement affect the conduct of bilateral safeguards on uranium imported to the Community from Canada, Australia, and the USA, and (c) will the Commission take steps to initiate amendments for the Euratom Treaty, Chapter 7, on safeguards to close the loophole that does not require knowledge of origin of civil nuclear materials?

* OJ No. C95, 17. 4. 89, p.5.

Answer given by Mr. Cardoso e Cunha
on behalf of the Commission
(17 March 1989)

The Commission confirms its previous statements to the European Parliament. Origin is a notion alien to safeguards: neither Chapter VII of the Euratom Treaty nor its implementing Regulation (EEC) No 3227/76 requires the Community safeguards system to verify it. The same applies, at world level, to IAEA safeguards.

This situation does not affect the proper implementation by Euratom of the international agreements concluded with Australia, Canada and the USA. The Commission maintains, throughout the Community, the tracking of nuclear material subject to these agreements. This material, however, even at the moment of its transfer to the Community, is not necessarily the same as that which physically originated in the third countries in question. This occurs because of the accepted fungibility of nuclear material, and origin cannot thus be relied upon or used in any way to determine, let alone to verify, the material actually falling within the scope of Community agreements.

The Commission does not intend to take any steps with a view to introducing origin into the Euratom safeguards system. Origin is irrelevant to the basic task entrusted to the Community by Article 2 e) of the Euratom Treaty, to make certain that nuclear material is not diverted to purposes other than those for which it is intended.

RAW MATERIALS

REPUBLIC OF SOUTH AFRICA

Third Quarter 1989 Production

Third quarter 1989 South African uranium production rose 6.1% from the second quarter, but was 18% lower than 1988's third quarter results. Compared to the first three quarters in 1988, production is down over 25% this year. If this trend continues for the fourth quarter, total 1989 production will be well under eight million pounds.

Most producers have recently been burdened with dramatically increased wages and reduced recovery grades. Hartbeestfontein reported a decline in profits in the third quarter, even though mining greater quantities of ore in an

attempt to offset lower recovery grades. In contrast, Anglo-American showed higher profits for this quarter, while contending with wage hikes and disappointing gold prices.

Although no operations have ceased uranium production this year, additional closures among the seven remaining operations may be expected in the near future unless the South African uranium industry can obtain some relief from current political and economic pressures. ■

Table 1
REPUBLIC OF SOUTH AFRICA
RECENT URANIUM PRODUCTION¹
(Thousands of Pounds U₃O₈)

Operation	Fourth Quarter 1988	First Quarter 1989	Second Quarter 1989	Third Quarter 1989	Percent Change ²
Buffelsfontein	238	231	216	221	-2.3
ERGO ³	104	109	105	80	-23.8
Freegold ⁴	282	256	224	262	+17.0
Harmony	85	0	0	0	0.0
Hartebeestfontein	200	199	182	183	+0.5
Stilfontein (Chemwes)	176	0	0	0	0.0
Vaal Reefs	1,067	962	941	1,011	+7.4
Western Areas	112	117	112	131	+17.0
TOTAL⁵	2,264	1,874	1,780	1,888	+6.1

¹Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.

²Change in percent from the second quarter of 1989.

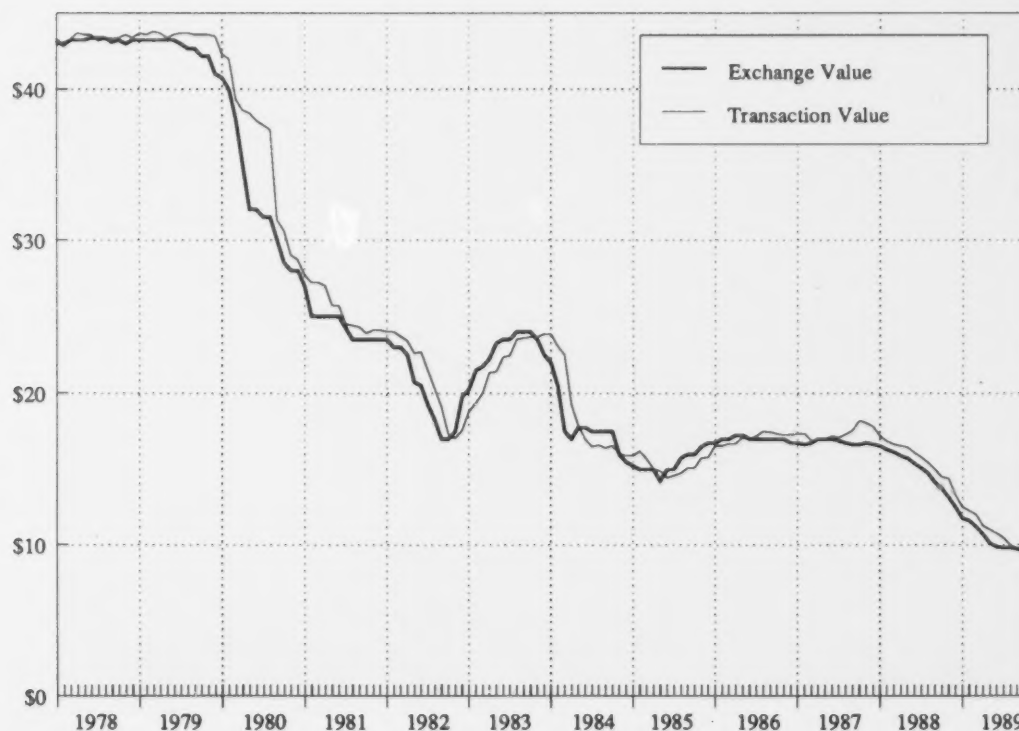
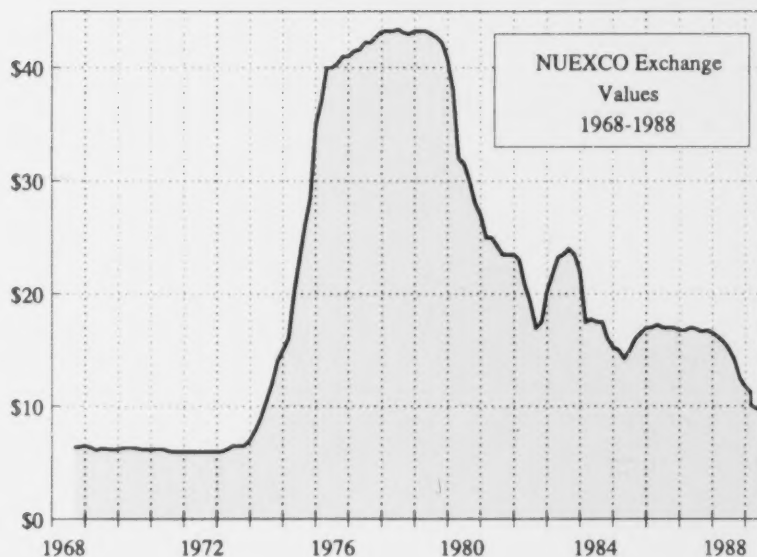
³ERGO = East Rand Gold and Uranium Company Ltd.

⁴Formerly Free State Joint Metallurgical Scheme.

⁵Columns may not add up due to rounding.

HISTORICAL MARKET DATA
**NUEXCO Historical
Exchange and
Transaction Values**

(In US Dollars/Pound U.S.)



HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40		

HISTORICAL US PREMIUM (Relative to the Exchange Value) Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	None	

HISTORICAL UF₆ VALUES Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25		

HISTORICAL MARKET DATA

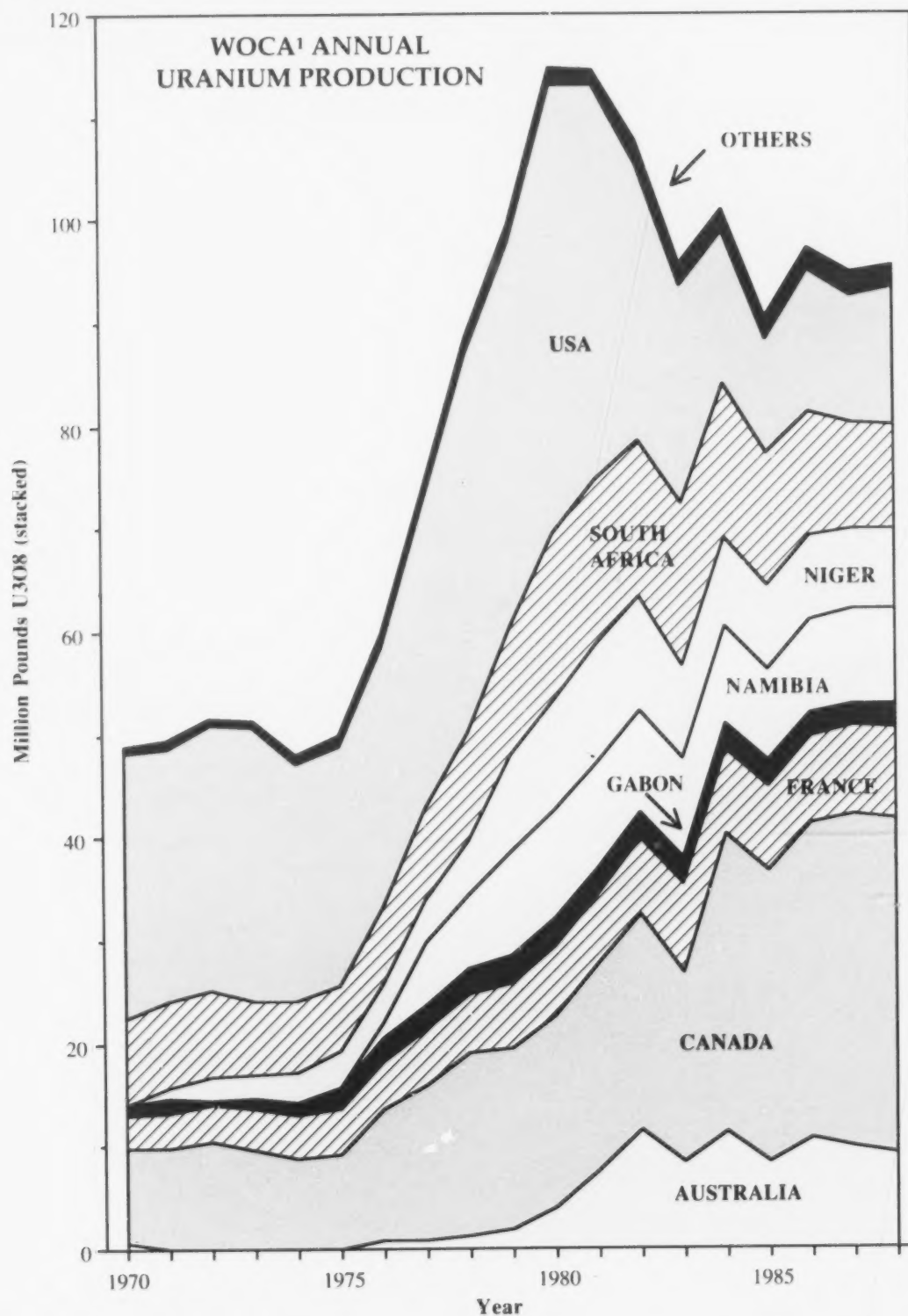
HISTORICAL US UF₆ PREMIUM (Relative to the UF₆ Value) Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	None	

HISTORICAL TRANSACTION VALUES Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.30	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.05	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.80	10.45	9.95	9.80	9.80	9.65		

HISTORICAL CONVERSION VALUES Determined as of the last day of the month indicated (\$US/lb U as UF ₆)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80		

HISTORICAL SWU VALUES (at 0.30 Percent Tails Assay) Determined as of the last day of the month indicated (\$US per SWU)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59		

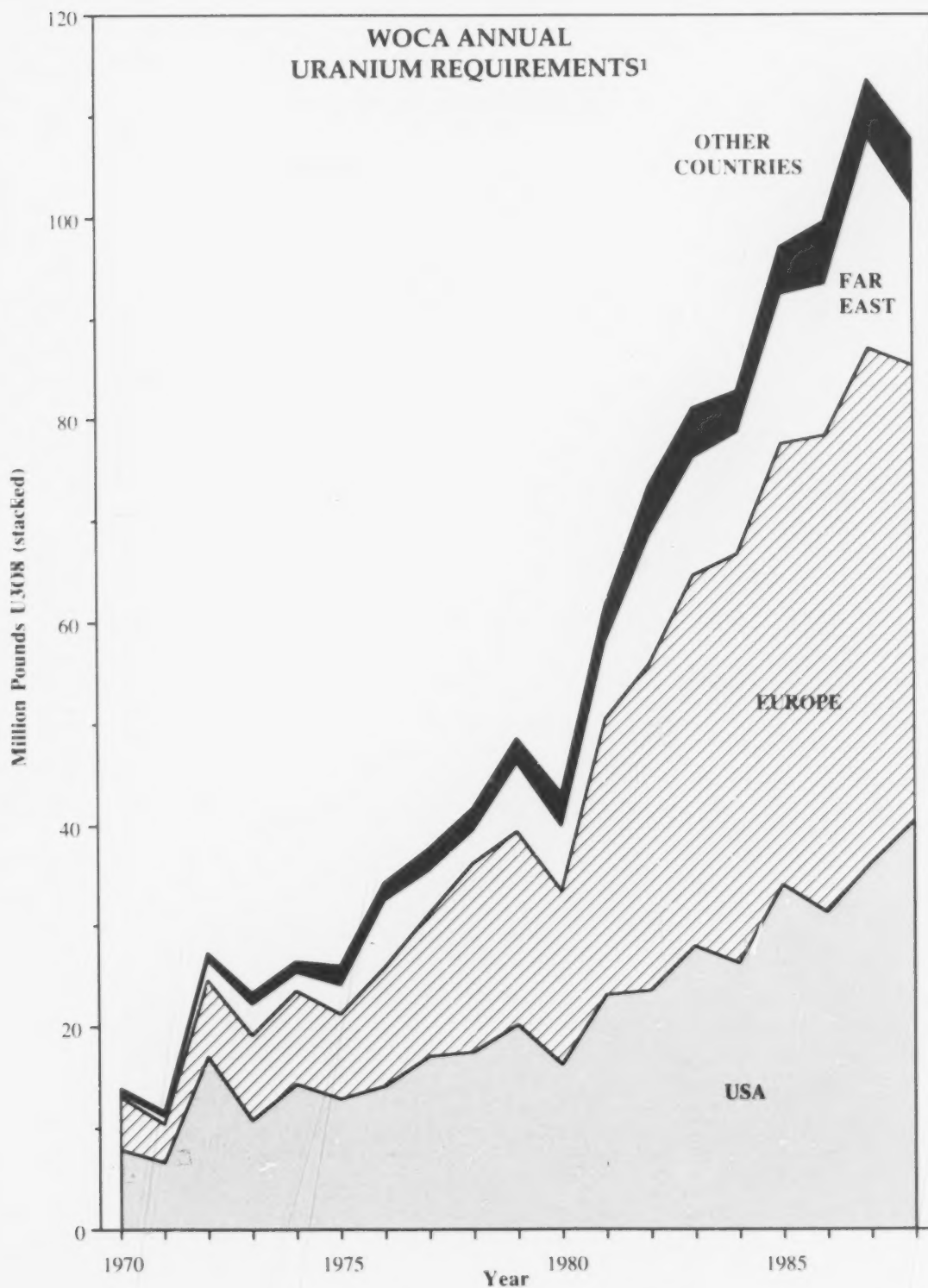
HISTORICAL MARKET DATA



¹ WOCA = World Outside of Centrally-Planned Economic Areas.

² World production in 1988 totalled 96.8 million pounds (Australia—9.3; Canada—32.3; France—8.9; Gabon—2.4; Namibia—9.2; Niger—7.8; South Africa—9.9, USA—13.5; Other—3.5).

HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual plant completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

HISTORICAL MARKET DATA

**VOLUME AND PRICE OF URANIUM DELIVERIES
TO THE EUROPEAN COMMUNITY¹**
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC ² (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ^{3,4}		Spot Contracts ^{3,4}	
			Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈	Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,500	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65R	\$16.13R

R = Revised

¹The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

²The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

⁴Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

HISTORICAL MARKET DATA

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	16.10	3.6	n/a	1.2
1977	29.9	27.8	19.75	5.6	n/a	4.0
1978	37.0	31.6	21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agencies

³ Includes imports by domestic utilities and domestic suppliers

GOVERNMENT STATISTICS

AUSTRALIA					
		Consumer Price Index ¹ (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ² (1984/1985 = 100)	Average Weekly Earnings — Adult Males — Australia (Australian dollars) ⁶	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates ³ (June 1985=100)
1980	Avg.	95.8	83.1	—	140.8 ^s
1981	Avg.	105.0	85.9	—	154.1 ^s
1982	Avg.	116.7	89.0	—	174.9 ^s
1983	Avg.	128.5	96.9	—	181.9 ^s
1984	Avg.	133.6	98.0	—	194.4 ^s
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
Jan	1989	—	110.6	—	122.2R
Feb	1989	—	111.2	521.90	122.2R
Mar	1989	188.0	114.9	—	123.1R
Apr	1989	—	117.5	—	123.2R
May	1989	—	118.6	531.50P	123.6R
June	1989	—	119.9	—	123.6
July	1989	—	120.1	—	123.6

P = Preliminary R = Revised since last month

¹Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

²Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

³Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

⁴Monthly data for the period 1967 to 1986 appear in Report 233.

⁵Base: June 1976 = 100.

⁶Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

GOVERNMENT STATISTICS

CANADA

Wage-earner Data:
Average Hourly Earnings (C\$)²

		Industrial Products Price Index: All Commodities ¹ (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells ³ (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	138.2	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	143.8	20.91	18.51	16.95	13.17	13.77
Jan	1989	130.7	146.8	21.22	19.45	18.14	13.75	13.82
Feb	1989	130.8R	147.8	22.05	19.51	18.26	13.79	13.89
Mar	1989	131.3R	148.5	21.90	19.65	18.35	13.62	14.10
Apr	1989	131.3R	149.0	22.37	19.80	18.40	13.57	14.16
May	1989	131.4R	150.5	21.89	20.02	18.17	13.76	14.27
June	1989	131.4R	151.3	21.89R	20.02R	18.17R	13.76R	13.22R
July	1989	131.3R	152.3	21.67	19.60	17.96	13.57	12.98
Aug	1989	131.2R	152.4	20.97P	19.50P	18.08P	13.47P	13.15P
Sept	1989	130.9	152.6	—	—	—	—	—

P = Preliminary R = Revised since last month

¹Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

²Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

³Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA							
		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand) ¹	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100) ²	Consumer Price Index ³ (1985 = 100)	Production Price Index All Groups ⁴ (1980 = 100)	Total Employment in Mining and Quarrying ⁵	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) ⁵
1980	Avg.	35.53	—	51.9	100.0	709,042	2,237,689
1981	Avg.	41.89	—	59.8	113.6	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	129.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	143.1	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	155.1	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	181.2	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	216.6	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	246.8	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	279.3	705,355	7,774,054
Jan	1989	—	—	166.8	299.8	714,593	704,320
Feb	1989	—	—	168.2	305.4	696,329	669,983
Mar	1989	112.29	262.8	170.9	310.0	702,746	695,843
Apr	1989	—	—	173.1	315.0	658,677	634,344
May	1989	—	—	175.9	319.6	—	—
June	1989	113.76	267.0	177.7	320.9	—	—
July	1989	—	—	179.3	324.0	—	—
Aug	1989	—	—	181.8	329.2	—	—
Sept	1989	—	—	183.4	—	—	—
P = Preliminary R = Revised since last month ¹Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236. ²Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982. ³Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 236. ⁴Central Statistical Service, Pretoria: All commodities for consumption in South Africa. ⁵Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.							

GOVERNMENT STATISTICS

UNITED STATES									
						Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴			
		Producer Price Index ¹		Consumer Price Index ²	GNP Implicit Price Deflator ³				
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
Jan	1989	109.4	110.5R	121.1	—	13.80	13.49	12.85	10.27
Feb	1989	110.1	110.8	121.6	—	13.66	13.48	12.88	10.26
Mar	1989	110.5	111.5	122.3	125.4	13.71	13.51	12.91	10.30
Apr	1989	111.8	112.3	123.1	—	13.68	13.65	12.92	10.31
May	1989	112.1R	113.2R	123.8	—	13.60	13.57	12.98	10.33
June	1989	112.3	112.8	124.1	126.0	13.62	13.66	12.98	10.37
July	1989	112.2	112.7	124.4	—	13.70R	13.75P	13.12R	10.41R
Aug	1989	111.4	112.0	124.6	—	13.67P	13.72P	13.09R	10.41R
Sept	1989	111.9	112.3	125.0	126.8	—	—	13.15P	10.46P

P = Preliminary R = Revised since last month

¹US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

²US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

³US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

⁴US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

CALENDAR

Nuclear Industry Calendar

1989

Nov. 26-29 *Nuclear Energy Forum* (Westin St. Francis, San Francisco, California), sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611.

**Nov. 26-
Dec. 1** *1989 ANS Winter Meeting* (Hilton Hotel, San Francisco, California). Contact the ANS Meetings Department at 1-312-352-6611.

1990

Jan. 22-26 *Nuclear Fuel Cycle Committee* (Las Vegas, Nevada), sponsored by the American Society for Testing and Materials. Contact Ms. Katharine Schaaf at the ASTM at 1-215-299-5529.

Mar. 4-8 *7th Pacific Basin Conference* (Sheraton Harbor Island Hotel, San Diego, California), sponsored by the ANS. Contact the ANS Meetings Department at 1-312-352-6611.

Mar. 25-28 *Fuel Cycle '90 Conference* (Opryland Hotel, Nashville, Tennessee), sponsored by the US Council for Energy Awareness. Contact the USCEA Conference Office at 1-202-293-0770.

Apr. 8-12 *First Annual International High-Level Radioactive Waste Management Conference* (Caesar's Palace Hotel, Las Vegas, Nevada), sponsored by the American Nuclear Society and American Society of Civil Engineers. Contact the ANS at Meetings Department at 1-312-352-6611.

Apr. 9-11 *23rd JAIF Annual Conference* (Kyoto, Japan). Contact Ms. Sachie Sugoh, Dept. of Planning and International Affairs, JAIF, at 03-508-9056.

Apr. 22-25 *INFO '90* (Westin Hotel, Dallas, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.

Sept. 5-7 *Uranium Institute 15th Annual Symposium* (London, United Kingdom). Contact the UI at 44-1-225-0308.

Sept. 16-19 *Uranium Seminar '90* (Hyatt Regency, San Antonio, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.

Nov. 11-14 *Nuclear Energy Forum* (Washington Hilton, Washington, D.C.), sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611.

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NUEXCO MONTHLY REPORT

November 1989, No. 255

* * *

EXECUTIVE SUMMARY

(All data as of October 31, 1989)

Exchange Value
\$9.40, down \$0.20The **Exchange Value** is **\$9.40** per pound U_3O_8 , down \$0.20 from last month.**UF₆ Value**
\$28.25, down \$1.50The **UF₆ Value** is **\$28.25** per kg U as UF₆, down \$1.50 from last month.**Natural Uranium**
Sales; Supply and
Demand

Six recent natural uranium sales are reported, involving approximately **1.1 million** pounds equivalent U_3O_8 . All of these sales involved spot or near-term delivery and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **7.9 million** pounds U_3O_8 equivalent, up approximately 2.7 million pounds since last month. Active spot and near-term **uranium demand** totals **5.9 million** pounds, up about 1.3 million pounds from last month. The spot and near-term **supply-demand ratio**, at **1.3 to 1**, increased slightly from last month's ratio of 1.2 to 1.

Transaction Value
\$9.65, down \$0.15The **Transaction Value** is **\$9.65** per pound U_3O_8 , down \$0.15 from last month. The calculation includes 17 transactions involving a total of approximately 2.5 million pounds U_3O_8 equivalent and covers a period of four months.**Loan Rate**
3.5%, unchangedThe **Loan Rate** is **3.5 percent** per annum, unchanged. One natural uranium loan is reported.**Conversion Value**
\$1.80, down \$0.10The **Conversion Value** is **\$1.80** per pound U as UF₆, down \$0.10 since last month. Three transactions for conversion services are reported.**SWU Value**
\$59, down \$4The **SWU Value** dropped \$4 to **\$59** per SWU. Two enrichment transactions are reported. Active demand is about the same as last month at 570 thousand SWU.

* * *

US High-level Waste
Program

Hampered by bureaucratic and political intervention, DOE's program for the permanent disposal of high-level nuclear waste in the USA has fallen far behind its original timetable. As criticism of DOE's management mounts, DOE plans to restructure its waste program.

Special Interview

Evidencing the recent spread of glasnost to the nuclear fuel industry, Mr. Boris V. Nikipelov, First Deputy Minister of the Soviet Ministry of Atomic Energy and Industry, shared with NUEXCO additional information about Technobexport and its growing commercial presence in the international nuclear fuel market.

Euratom Supply
Agency

For more than thirty years, the Euratom Supply Agency has overseen uranium contracting practices of the European Community, acting primarily as an administrative agency. In 1988, however, the Agency expanded its purview and began inhibiting certain transactions, which aroused some criticism. NUEXCO examines the role, legal limitations, and political structure of the Supply Agency as we enter the 1990s.

NUEXCO REPORT 255 FIGURES OF THE MONTH (October 31, 1989)	This Month (Report 255)	Last Month (Report 254)	12 Months Ago (Report 243)
Exchange Value (\$US per pound U ₃ O ₈)	9.40	9.60	13.15
US Premium for the Exchange Value (\$US per pound U ₃ O ₈)	—	—	0
UF₆ Value (\$US per kg U as UF ₆)	28.25	29.75	39.00
US Premium for the UF ₆ Value (\$US per kg U as UF ₆)	—	—	0
Transaction Value (\$US per pound U ₃ O ₈ equivalent)	9.65	9.80	14.40
Loan Rate (Per Annum)	3.5%	3.5%	3.5%
Conversion Value (\$US per pound U as UF ₆)	1.80	1.90	1.95
Near-Term Uranium Supply ¹ (millions of pounds U ₃ O ₈)	7.9	5.2	6.4
Near-Term Uranium Demand ² (millions of pounds U ₃ O ₈)	5.9	4.3	1.2
Near-Term Supply-Demand Ratio	1.3	1.2	5.6
Recent Uranium Sales: ³			
Number of Transactions	6	9	7
Quantity of Material (Millions of pounds U ₃ O ₈ equivalent)	1.1	5.1	3.9
Nuexco SWU Value: (\$US per SWU) ⁴			
at 0.3 tails assay	59	63	65
US DOE SWU Prices: (\$US per SWU)			
USEC	117.00 ⁴	117.00 ⁴	117.00 ⁴
AFC	153.00 ⁶	153.00 ⁶	153.00 ⁶
Requirements	157.00 ⁶	157.00 ⁶	157.00 ⁶
Incentive Price	90.00 ⁷	90.00 ⁷	90.00 ⁷
Market Value of Enriched UF₆ ⁸ : (\$US per kg U as UF ₆)			
2.5 w/o U ₂₃₅	303	317	372
3.0 w/o U ₂₃₅	389	408	477
3.5 w/o U ₂₃₅	478	501	583
4.0 w/o U ₂₃₅	568	596	691

¹Active inquiries to sell, for delivery within 12 months after contract signing.

²Active inquiries to purchase, for delivery within 12 months after contract signing.

³Uranium sales only; does not include loans, conversion, or SWU transactions.

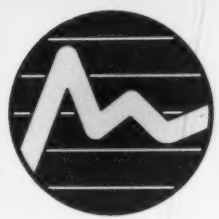
⁴Effective since 10/1/87.

⁵Effective since 10/1/86.

⁶Effective since 10/1/84.

⁷Effective since 10/1/86, for up to 30% of annual requirements.

⁸Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.



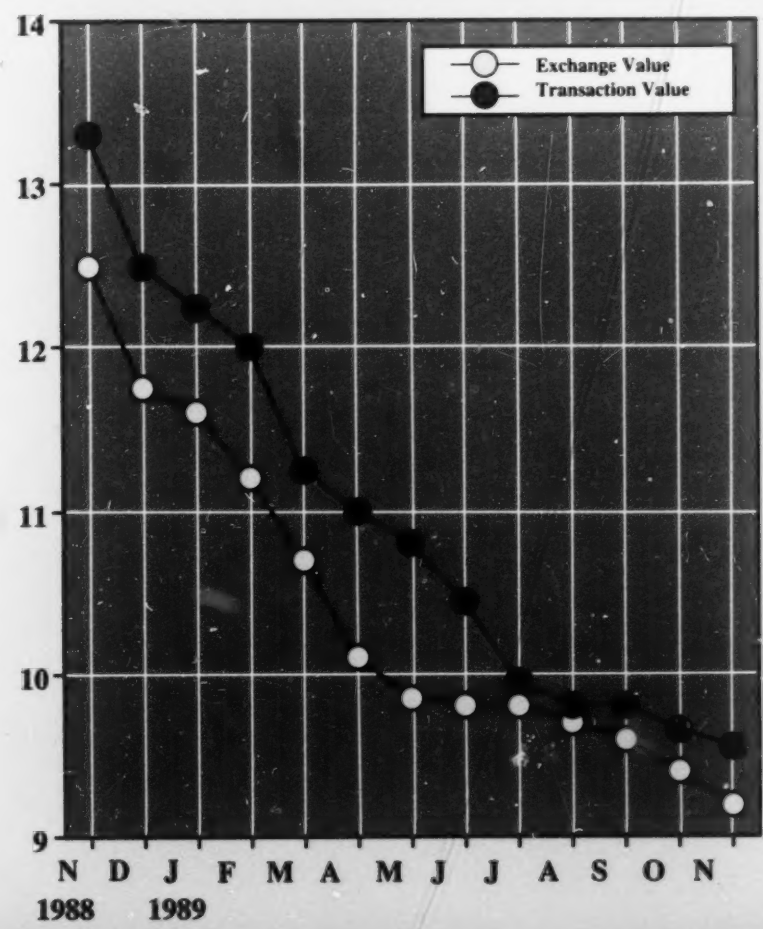
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Monthly Report

December 1989
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To Our Readers

We are pleased to announce that Mr. **Kenten D. Lindberg** has joined the NUEXCO organization.

Kent obtained his Bachelor of Science degree in Industrial Engineering from Purdue University and a Masters in Business Administration from Washington State University. He held various production management positions with Boise Cascade Corrugated Container Division, and was responsible for the operation of a high-volume production plant. Previously, Kent was a sales engineer for Reliance Electric Company. Kent has worked in West Germany, and also attended an intensive language and cultural program in China.

Kent is the grandson of Harold (Lindy) Lindberg, NUEXCO's representative to many of the Eastern US utilities. Based in Denver, Kent will work with the NUEXCO publications group.



PRICING
MARKET VALUES SUMMARY

November 30, 1989	Market Values	Active Supply* (thousands)	Active Demand* (thousands)
EXCHANGE VALUE ¹	\$9.20/lb U ₃ O ₈	8,310**	2,645**
UF ₆ VALUE ²	\$27.75/kg U as UF ₆		
LOAN RATE ³	3.5%/annum	7,660	0
CONVERSION VALUE ⁴	\$1.75/lb U as UF ₆	2,120	0
SWU VALUE ⁵ 0.3 tails assay:	\$57/SWU	980	400

	\$/lb. U ₃ O ₈	Millions of Pounds	Number of Transactions	Number of Months
TRANSACTION VALUE ⁶	9.55	3.5	17	3

*Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

**For both uranium concentrates and uranium hexafluoride.

DEFINITIONS

¹ The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

² The **UF₆ Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

³ The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

⁴ The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

⁵ The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

⁶ The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:

- Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
- At least ten transactions;
- Transactions involving a sum total of at least 2 million pounds U₃O₈ equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

- All Market Values are based on:
 - Data from recently completed transactions.
 - Data from pending transactions.
 - Firm bids to buy or borrow, and firm offers to sell or lend.
 - Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
 - Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
- In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers.
- The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
- For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
- In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

PRICING

**NATURAL URANIUM AND
SPOT CONVERSION**

(All data as of November 30, 1989)

Spot market volume for uranium sales doubled from last month to 2.2 million pounds U₃O₈ equivalent. This figure includes four U₃O₈, two UF₆, and two enriched uranium product sales, almost all of which involved US parties. Lending activity was limited to one transaction. Two conversion sales took place, and three enrichment sales are reported, two of which involved SWU contained in enriched uranium product (EUP).

Natural uranium concentrate prices declined in November with each successive sale, and at the end of the month the **Exchange Value** dropped \$0.20 to **\$9.20** per pound U₃O₈. Four U₃O₈ transactions occurring in November are reported, and all involved US entities, with the exception of one seller based in Europe. Each sales opportunity elicited aggressive pricing from both producers and traders.

The Recent Transactions table on page six of this Report lists four additional near-term U₃O₈ sales which occurred earlier in 1989. Consequently, they are excluded from this month's sales volume figure.

Decisions are expected shortly from several utilities currently evaluating U₃O₈ offers for near-term delivery priced near today's Exchange Value, while a handful of utilities are considering long-term proposals.

The **UF₆ Value** registered a \$0.50 decline from last month to **\$27.75** per kgU as UF₆. Intermediaries acted as sellers in the two reported UF₆ transactions, both of which were concluded at prices at or near the new UF₆ Value. Uranium contained in EUP accounted for about one third of the sales activity. There is a widespread perception that the UF₆ market is not only oversupplied,

but that this imbalance will worsen in the coming months. Inventories held in the form of UF₆, both natural and enriched, are being forced into the market, and the expected liquidation of one US utility's inventory of more than one million pounds equivalent will also increase the supply excess.

Since last month, **Active Supply** increased by about 400 thousands pounds to **8.3 million pounds** U₃O₈ equivalent, its highest level since January. Demand for U₃O₈ and UF₆, however, has decreased substantially (almost 50 percent) since last month as a number of buyers filled firm and discretionary requirements, and only a few new buyers have shown interest in taking first quarter 1990 deliveries. The November purchases did little to clear the market of excess supplies of natural uranium. The new **Supply/Demand Ratio** increased to **3.1 to 1**, compared to 1.3 to 1 in October.

Namibia completed its first national elections early in November, and it is expected that US sanctions against Namibian uranium imports will be lifted early in 1990. If so, the availability of Namibian-origin material could increase competition for those opportunities involving purchasers who were previously barred from purchasing Namibian uranium.

The **Transaction Value** fell \$0.10 to **\$9.55**. Its calculation includes 17 transactions occurring over three months and totalling approximately 3.5 million pounds U₃O₈ equivalent.

The **Loan Rate** is unchanged at **3.5 percent** per annum. One loan is reported, involving a number of special circumstances including changes in location and origin. One other loan is in negotiation.

PRICING

Under pressure from the large supplies of UF₆ overhanging the market, the **Conversion Value** declined \$2.05 to **\$1.75**. Two conversion transactions are reported this month, one in the USA and one in Europe. In addition, one long-term sale, which was concluded earlier in 1989, is shown in the page 7 conversion transactions listing.

Competition among US and European converters in the spot market continues to exert downward pressure on near-term conversion prices. As a result, over the past few months the gap between European and US conversion prices has disappeared. Several utilities are evaluating long-term conversion offers, with decisions expected soon.

ENRICHMENT

In an unusually active month, the **SWU Value** fell 3.4 percent to **\$57** per SWU, and active supply and demand both decreased. A US utility purchased a small quantity of SWU, while two other US entities bought SWU contained in EUP. One of these utilities is again seeking SWU, for delivery in late 1990. Secondary market supplies of SWU and EUP remain plentiful and there is a high probability that additional material will be available in 1990.

CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹						
Country (currency)	per lb U ₃ O ₈ as Concentrates			per kg U as Concentrates		
	This Month (Nov 30, 1989)	Last Month (Oct 31, 1989)	12 Months Ago (Nov 30, 1988)	This Month (Nov 30, 1989)	Last Month (Oct 31, 1989)	12 Months Ago (Nov 30, 1988)
Australia (dollar)	11.79	12.01	14.27	30.66	31.21	37.10
Belgium (comm. franc)	345.48	362.24	454.26	898.16	941.73	1,181
Canada (dollar)	10.73	11.03	14.93	27.89	28.68	38.81
EEC (ecu)	8.05	8.42	10.44	20.93	21.89	27.13
Finland (markka)	38.62	39.93	51.29	100.41	103.81	133.35
France (franc)	56.10	58.57	74.10	145.84	152.26	192.63
FRG (mark)	16.45	17.25	21.69	42.76	44.84	56.39
Italy (lira)	12,131	12,663	16,046	31,537	32,922	41,717
Japan (yen)	1,314	1,334	1,524	3,417	3,468	3,962
Netherlands (guilder)	18.55	19.47	24.41	48.22	50.61	63.47
South Africa (rand)	23.93	24.73	29.06	62.22	64.29	75.54
Spain (peseta)	1,060	1,098	1,418	2,755	2,855	3,685
Sweden (krona)	58.67	60.22	75.39	152.53	156.55	196.00
Switzerland (franc)	14.65	15.10	18.13	38.08	39.25	47.15
UK (pound)	5.88	5.94	6.78	15.28	15.45	17.62
US (dollar)	9.20	9.40	12.50	23.92	24.44	32.50

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹						
Country (currency)	per lb U ₃ O ₈ as Concentrates			per kg U as Concentrates		
	This Month (Nov 30, 1989)	Last Month (Oct 31, 1989)	12 Months Ago (Nov 30, 1988)	This Month (Nov 30, 1989)	Last Month (Oct 31, 1989)	12 Months Ago (Nov 30, 1988)
Australia (dollar)	12.24	12.32	15.18	31.83	32.04	39.47
Belgium (comm. franc)	358.62	371.87	483.34	932.33	966.78	1,257
Canada (dollar)	11.14	11.32	15.88	28.95	29.44	41.30
EEC (ecu)	8.36	8.64	11.10	21.72	22.47	28.87
Finland (markka)	40.09	40.99	54.58	104.23	106.58	141.88
France (franc)	58.23	60.12	78.84	151.39	156.31	204.96
FRG (mark)	17.07	17.71	23.08	44.38	46.03	60.00
Italy (lira)	12,592	13,000	17,073	32,737	33,797	44,386
Japan (yen)	1,364	1,369	1,622	3,547	3,560	4,216
Netherlands (guilder)	19.25	19.99	25.98	50.06	51.96	67.53
South Africa (rand)	24.84	25.39	30.92	64.59	66.00	80.37
Spain (peseta)	1,100	1,127	1,508	2,860	2,930	3,921
Sweden (krona)	60.90	61.82	80.22	158.33	160.72	208.55
Switzerland (franc)	15.20	15.50	19.29	39.53	40.30	50.16
UK (pound)	6.10	6.10	7.21	15.86	15.86	18.75
US (dollar)	9.55	9.65	13.30	24.83	25.09	34.58

¹Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹						
Country (currency)	per lb U as UF ₆			per kg U as UF ₆		
	This Month (Nov 30, 1989)	Last Month (Oct 31, 1989)	12 Months Ago (Nov 30, 1988)	This Month (Nov 30, 1989)	Last Month (Oct 31, 1989)	12 Months Ago (Nov 30, 1988)
Australia (dollar)	2.24	2.30	2.23	4.95	5.07	4.91
Belgium (comm. franc)	65.72	69.36	70.87	144.88	152.92	156.23
Canada (dollar)	2.04	2.11	2.33	4.50	4.66	5.13
EEC (ecu)	1.53	1.61	1.63	3.38	3.55	3.59
Finland (markka)	7.35	7.65	8.00	16.20	16.86	17.64
France (franc)	10.67	11.21	11.56	23.52	24.72	25.48
FRG (mark)	3.13	3.30	3.38	6.90	7.28	7.46
Italy (lira)	2,307	2,425	2,503	5,087	5,346	5,519
Japan (yen)	250.00	255.43	237.75	551.16	563.12	524.14
Netherlands (guilder)	3.53	3.73	3.81	7.78	8.22	8.40
South Africa (rand)	4.55	4.74	4.53	10.04	10.44	9.99
Spain (peseta)	201.57	210.26	221.14	444.38	463.53	487.53
Sweden (krona)	11.16	11.53	11.76	24.60	25.42	25.93
Switzerland (franc)	2.79	2.89	2.83	6.14	6.37	6.24
UK (pound)	1.12	1.14	1.06	2.46	2.51	2.33
US (dollar)	1.75	1.80	1.95	3.86	3.97	4.30

SWU VALUE AND UF ₆ VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹				
Country (currency)	SWU Value at 0.30% Tails Assay This Month (Nov 30, 1989)	SWU Value at 0.30% Tails Assay Last Month (Oct 31, 1989)	UF ₆ Value per kg U as UF ₆ This Month (Nov 30, 1989)	UF ₆ Value per kg U as UF ₆ Last Month (Oct 31, 1989)
Australia (dollar)	73.08	75.35	35.38	36.07
Belgium (comm. franc)	2,140	2,274	1,036	1,089
Canada (dollar)	66.46	69.24	32.18	33.15
EEC (ecu)	49.87	52.84	24.14	25.29
Finland (markka)	239.29	250.64	115.86	120.00
France (franc)	347.56	367.60	168.29	176.01
FRG (mark)	101.89	108.26	49.33	51.83
Italy (lira)	75,158	79,483	36,392	38,057
Japan (yen)	8,143	8,372	3,943	4,009
Netherlands (guilder)	114.92	122.20	55.64	58.51
South Africa (rand)	148.28	155.22	71.80	74.32
Spain (peseta)	6,565	6,892	3,179	3,300
Sweden (krona)	363.50	377.96	176.00	180.97
Switzerland (franc)	90.75	94.76	43.94	45.37
UK (pound)	36.41	37.31	17.63	17.86
US (dollar)	57.00	59.00	27.60	28.25

¹Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.



CURRENT MARKET DATA

RECENT TRANSACTIONS ¹						
URANIUM SALES						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U ₃ O ₈ equivalent)	Approximate Price Range ² as Percent of Current Exchange or UF ₆ Value	Seller	Buyer	Remarks
4630	1989	50-100	See Remarks	R ³	Producer	Transaction Occurred Earlier in 1989
4634	1989	601-1,000	See Remarks	Producer	R ³	Transaction Occurred Earlier in 1989
4677	1989	101-300	See Remarks	Producer	Utility	Transaction Occurred Earlier in 1989
4686A	1989	Less than 50	See Remarks	Intermediary	Intermediary	Contained in LEU
4687	1990	50-100	103-107	Intermediary	Utility	
4688	1990	101-300	See Remarks	Producer	Intermediary	Transaction Occurred Earlier in 1989
4689	1989	101-300	98-102	Intermediary	Producer	
4690	1990	601-1,000	98-102	Intermediary	Producer	
4692	1989	101-300	98-102	Intermediary	Utility	
4693	1989	101-300	98-102	R ³	Intermediary	UF ₆
4696A	1990	601-1,000	See Remarks	Intermediary	Utility	Contained in LEU
4697	1990	101-300	98-102	Intermediary	Intermediary	UF ₆
¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information. ² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range. ³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.						

CURRENT MARKET DATA
LOAN TRANSACTIONS¹

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of UOx equivalent)	Approximate Price Range ² as Percent of Current Loan Rate	Lender	Borrower	Remarks
4691	1990	601-1,000	R ³	Utility	Intermediary	

**CONVERSION SERVICES
SPOT MARKET SALES¹**

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U equivalent)	Approximate Price Range ² as Percent of Current C.V.	Seller	Buyer	Remarks
4645	1991-95	301-600	R ³	Converter	Utility	
4685	1989-93	3,001-6,000	See Remarks	Converter	Utility	Transaction Occurred Earlier in 1989
4699	1990-91	601-1,000	R ³	Intermediary	Utility	

**ENRICHMENT SERVICES
SECONDARY MARKET SALES¹**

NUEXCO Transaction Number	Delivery Period	Approximate Quantity ⁴ (thousand SWUs)	Approximate Price Range ² as Percent of Current SWU Value ⁵	Seller	Buyer	Remarks
4686B	1989	Less than 50	See Remarks	Intermediary	Intermediary	Contained in LEU
4694	1990	Less than 50	98-102	Intermediary	Utility	
4696B	1990	101-300	See Remarks	Intermediary	Utility	Contained in LEU

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

⁴ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 w/o tails assay.

⁵ Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.



CURRENT MARKET DATA

URANIUM SUPPLY (November 30, 1989)			
Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Available for Sale ACTIVE			
88-1026	150	—	1990
89-1001	1,300	1,000 per year	1990, UF ₆
89-1128*	1,130	—	1990, U ₃ O ₈ /UF ₆
89-1156	200	—	1990
89-1180	1,000	—	1990
89-1188*	150	—	1990
89-1194	100	—	1990
89-1201*	3,000	—	1990
89-5000A	1,280	—	1990, UF ₆
.....			
Total	8,310		
INACTIVE			
88-1081	340	—	1990, UF ₆
89-1029	1,200	300 per year	1990-98
89-1076*	500	250 per year	1990 on
89-1173	1,000	—	1990
89-1209*	400	—	1990-93
89-1239*	200	400 per year	1990, UF ₆
.....			
87-1005	—	250 per year	1990-95
87-1109	—	350 per year	1990-on
87-1123	—	1,000 per year	1990-on
88-1157	—	1,000 per year	1990 on, UF ₆
Total	3,640		
* New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 88-1001, 89-1200.			

CURRENT MARKET DATA

URANIUM DEMAND (November 30, 1989)			
Delivery Period¹ (Thousand Pounds of U₃O₈)			
NUEXCO Project Number	Spot or Near-term²	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
89-1175	170	170 per year	1990-91
89-1183	400	—	1990
89-1208	95	—	1990
89-1218	1,000	1,000 per year	1990-93
89-1230*	100	—	1990
89-1232*	270	—	1990
89-1138*	360	—	1990, UF ₆
89-1241*	250	—	1990
.....			
88-1227	—	1,600	1990-95, U ₃ O ₈ /UF ₆
89-1090	—	150 per year	1991-96
89-1172	—	500 per year	1992 on
89-1176	—	600 per year	1991-96
89-1192	—	1,200	1992-97
89-1233*	—	160	1991, UF ₆
89-1236*	—	250	1991-94, U ₃ O ₈ /UF ₆
89-1242*	—	100 per year	1992-93
Total	2,645		
INACTIVE			
89-1067	500	—	1990
89-1163	1,000	—	1990
89-1167	350	350 per year	1990-94
89-1187	325	—	1990, UF ₆
89-1189	500	—	1990
.....			
89-1237*	—	150 per year	1990
Total	2,675		
[*] New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 89-1068, 89-1133, 89-1142A, 89-1164, 89-1199, 89-1210, 89-1224.			

CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND			
(November 30, 1989)			
Delivery Period ¹			
(Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
87-1167	460	—	UF ₆
88-1182	4,000	—	U ₃ O ₈ /UF ₆
89-1077	500	—	U ₃ O ₈
89-1184	200	—	U ₃ O ₈
89-1186	200	—	U ₃ O ₈
89-1196	1,300	—	UF ₆
89-1206	300	—	U ₃ O ₈
89-1225	700	—	U ₃ O ₈
Total	7,660		
INACTIVE			
None reported			
Available to Borrow:			
No inquiries to borrow are reported			
* New or revised since last month.			
¹ Measured from the date of this Report.			
Projects removed since last month: 89-1213.			

CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND (November 30, 1989)			
Delivery Period¹ (Thousand Pounds of U as UF₆)			
NUEXCO Project Number	Within 3 Years	Beyond 3 Years	Remarks
Available for Sale ACTIVE			
89-5000C*	1,080	—	
89-5001A*	440	—	
89-5002*	600	—	
Total	2,120		
Inquiries to Purchase <i>No inquiries to purchase conversion services are reported</i>			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 89-1212.			

CURRENT MARKET DATA

SWU SUPPLY AND DEMAND (November 30, 1989)			
Delivery Period ¹ (Thousand SWUs)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Available for Sale ACTIVE			
88-1082	25	—	1990
88-1096	190	—	1990
88-1200	15	—	1990
88-1210	300	—	1990
89-5000B*	250	—	1990
89-5001B*	200	—	1990
Total	980		
INACTIVE			
87-1128	360	—	1990
Total	360		
Inquiries to Purchase ACTIVE			
88-1236	250	—	1990-94
89-1243*	150	—	1990
.....			
88-1061	—	500	1991-95
89-1203*	—	135	1991-92
Total	400		
INACTIVE			
89-1043	50	—	1990
.....			
89-1047	—	600	1991-95
Total	50		
* New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 89-1142B, 89-1211, 89-1214.			

RECENT DEVELOPMENTS

NAMIBIA

Namibian Elections

Having peacefully conducted its first national election November 7-11, Namibia has taken an important step towards gaining its independence from South Africa. As expected, the South-West African People's Organization (SWAPO) won 57 percent of the votes, although the party fell short of obtaining the two-thirds majority required to write its own constitution. Almost 97 percent of the electorate turned out to vote for one of the ten registered parties and political alliances.

Following the elections, United Nations Special Representative for Namibia Martti Ahtisaari announced, "I have told the Administrator-General that I am satisfied that the voting process has been free and fair in accordance with UN Resolution 435 and have agreed that the process of counting votes should go forward." On November 13, after almost 700,000 votes had been tabulated, the UN formally certified the elections.

The election was held to create a 72-member constituent assembly based proportionately on the share of votes received by each party. Working quickly, the assembly convened on November 21, and elected Hage Geingob, a moderate SWAPO leader, chairman, and established the "Principles for a Constitution for an Independent Namibia". These principles are the same as those established in a 1982 supplement to the UN Security Council Resolution 435 which called for the independence of Namibia, and are based on multi-party democracy. They call for executive, legislative and judicial branches to be governed by the Constitution, and provide for human rights and freedoms.

Namibia's constitution must be approved by a two-thirds majority of the constituent assembly, and thereafter ratified by the UN Security Council. It appears this will be completed as scheduled by April 1, 1990, at which time the US has said it will lift sanctions against Namibia if the country is independent. US sanctions could be lifted earlier through Congressional action. However, Sam Nujoma, the President of SWAPO, recently told the press that he was not prepared to call on the UN to lift economic sanctions against Namibia until it is formally declared independent.

NAMIBIAN ELECTION RESULTS November 7-11, 1989

Party or Political Alliance	Percent of Vote	Assembly Seats Acquired
SWAPO	57.3	41
Democratic Turnhalle Alliance	28.6	21
United Democratic Front	5.6	4
Action Christian National	3.5	3
Federal Convention of Namibia	n/a	1
Namibian National Front	n/a	1
National Patriotic Front	n/a	1

During the past several years, Namibia's sole uranium mine, Rössing, has maintained its usual production levels to retain its skilled work force and continue its reputation as a reliable supplier. The new Namibian government will have a 51-percent voting share in Rössing. Although it will not own any of the company assets, it will have the majority voice in how the company is run. According to the Chairman of Rössing, Dr. Zed Ngavirue, the company payroll accounts for 11 percent of the salaries paid in Namibia's private sector, and the new national leaders will be looking to Rössing to help improve economic health and employment.

UNITED KINGDOM

Nuclear Power To Remain in Public Sector

On November 9, UK Energy Secretary John Wakeham announced the government's decision to exclude nuclear power from its electricity privatization program due to

RECENT DEVELOPMENTS

uncertainties about nuclear energy's costs. Wakeham also reported that, although construction would continue on Sizewell-B, three other planned PWRs would be deferred, and not reconsidered until after Sizewell-B is completed. Although the announcement to abandon the nuclear program came as little surprise to many, the decision was particularly painful, since British scientists pioneered the development of nuclear energy for peaceful uses in the 1950s.

A recent government study assessing nuclear costs at more than twice those of other electricity sources was the catalyst for the decision, as it publicized serious questions about nuclear power's ability to attract private investors. These fears were exacerbated by recent estimates on clean-up costs of the Magnox stations and AGRs which rose sharply, and a ten-percent hike in the estimated completion costs of Sizewell-B.

In order to minimize the financial risks associated with nuclear power plants, National Power, the larger of Central Electricity Generating Board's (CEGB) two successors which was to be responsible for the nuclear sector, sought financial guarantees. The government considered requiring the ten area electricity distribution companies to purchase a minimum amount of non-fossil electricity, and imposing a tax on nuclear electricity production. Recently government advisors estimated that this nuclear levy could equal one-fourth the average wholesale cost of power for the distribution companies. Because subsidization of the industry would run counter to privatization goals and deter private investment, and amid fears that such a high tax could spawn other, more competitive energy projects, the government elected to keep nuclear energy under its auspices.

John Collier, Chairman of the UK Atomic Energy Authority, will head the new government corporation. Collier noted that the government's cost study does not accurately reflect nuclear energy's costs because it was based on the rate of return required by private investors in the UK (eight percent for a guaranteed market, and 15 percent without guarantees), compared to the government's requirement of five percent. Collier believes that nuclear power will return as a major option for the UK after 1994, and he plans to promote its earliest possible revival.

As scheduled, National Power and PowerGen, CEGB's other successor, will manage all conventional power plants, while the as yet unnamed government corporation will control the fourteen operating commercial nuclear power plants and Sizewell-B when completed.

USA

ABB-Combustion Engineering Merger

Combustion Engineering (CE) has announced an agreement to merge with the giant Swedish-Swiss engineering group Asea Brown Boveri Ltd. (ABB). The November 13 announcement prompted CE to be the most actively traded stock on the New York Stock Exchange that day. Its value increased by more than \$13 to \$39, just below ABB's \$40-per-share offering price.

The \$1.6 billion merger was selected as the most effective method of developing joint opportunities, and followed earlier discussions between the two companies concerning possible cooperation in the field of power generation. ABB, formed last year by the merger of Asea (Sweden) and BBC Brown Boveri (Switzerland), is the world's largest power-equipment supplier with 1988 sales of almost \$20 billion. US revenues last year for ABB and CE were about the same at \$3.5 billion each.

The merger will improve ABB's presence in the US market, via CE's knowledgeable sales staff and customer contacts, and will provide CE with greater technological and financial resources. Plans are for CE to maintain its present management structure and headquarters in Stamford, Connecticut.

This action underscores ABB's commitment to continued worldwide growth. In June 1988, ABB and Westinghouse agreed to market nuclear services in Europe—an enterprise expected to generate annual revenues of \$100 million. ABB also announced plans to acquire Westinghouse's remaining interest in a US-based power transmission and distribution joint venture and recently completed a public offer to purchase all outstanding interests (22%) in ABB's West German unit, Asea Brown Boveri AG. CE and ABB also have a strong presence in Eastern Europe and the Soviet Union, and CE and Finland's Neste Corp. signed a \$2 billion agreement with the Soviet Union to construct and operate three petrochemical plants in western Siberia.

The impending CE-ABB merger adds to the growing competition for the \$11.5 billion US nuclear services market. Only three months ago, Babcock & Wilcox and Framatome S.A. announced a joint venture aimed at capturing more US market share. ■

RECENT DEVELOPMENTS

WASHINGTON FOCUS

The first session of the 101st Congress ended at 4 a.m. on November 22, 1989. Before leaving, the Senate confirmed William Young as Assistant Secretary for Nuclear Energy at DOE and Forrest Remick as NRC Commissioner. In addition, the Senate passed the budget reconciliation bill authorizing the NRC to collect 45% of its budget for FY 1990 from utilities, which amounts to approximately \$1 million per plant. The budget bill also contributes \$4.6 billion to deficit reduction by allowing the Gramm-Rudman reductions to remain in effect through the first week of February. Although Congress passed the State Department authorization bill, which included nuclear export sanctions against China, on November 21 the President vetoed the bill. Congress will reconvene on January 23, 1990.

William Young Nomination

On November 3, the Senate Energy and Natural Resources Committee held a confirmation hearing on William Young's nomination as Assistant Secretary for Nuclear Energy. His four goals are to:

- reorganize the Office of Nuclear Energy emphasizing stricter line management and make safety a primary goal in the operations of DOE's reactors,
- promote nuclear power as an option in the domestic energy mix and promote advance reactor designs,
- support legislative efforts to restructure the Department's uranium enrichment program and resolve questions about the future of the AVLIS process, and
- support development of small nuclear power systems for future space and military missions.

AVLIS Update

On November 7, William Young responded to questions on AVLIS submitted by Senators J. Bennett Johnson (D-LA) and Wendell Ford (D-KY) at the November 3 Senate Energy and Natural Resources Committee hearing. Senator Ford was concerned that AVLIS could end up the GCEP of the 1990s, and said "I'm not convinced that there is an adequate and timely plan for AVLIS deployment." Young indicated the Administration's continued support for AVLIS development and stated that a decision on deployment would be made after a full-scale demonstration, planned for 1992.

Concerning DOE's progress on including industrial participants in the demonstration phase of the AVLIS program, Young responded that DOE plans to set up an outside review group of business and technical experts from the industry, implement an industrial access program, and competitively select an industrial firm for implementing the transition of AVLIS technology to production. Responsibilities of this company could include construction and operation of a production plant. The details of this plan will be sent to Congress with the FY 1991 budget request.

For the first time, DOE admitted that defense funding for the Special Isotopic Separation (SIS) program is directly linked to AVLIS R&D, and revealed that the programs have been jointly funded since 1979, sharing lasers, process development, and project management. Successful completion of AVLIS assumes joint funding from both DOE and DOD of \$20 to \$30 million through FY 1991. Should either program reduce or eliminate its contribution to the shared costs, the other would be forced to make up the difference or reduce its program activities, thereby slipping schedule.

RECENT DEVELOPMENTS

 DOE Power Costs

**Enrichment Plant
Licensing**

**Enrichment Restructuring
Legislation**

The Committee asked about the status of a management review and establishment of an industrial access program for AVLIS required by the Energy & Water Development Appropriations bill for FY 1990. DOE responded the plan is expected to be submitted to the Secretary by year end and will describe its management approach, the resources necessary to take AVLIS through the demonstration phase, outline the major milestones between demonstration and deployment, and recommend the approach to be taken with deployment. Joseph M. Farley, Vice President of Nuclear, Southern Company Services, is one of the utility members DOE asked to assist with the management review and AVLIS industrial access program. DOE has selected Argonne National Laboratory to assist with the site selection process and the EIS. It plans to pursue draft site criteria sometime in the spring of 1990.

DOE has completed a preliminary analysis of the impact of acid rain legislation on the two utilities which supply power to the gas diffusion plants. If the Clear Air Act is passed, DOE estimates its power costs will increase from \$55 per SWU to \$70 per SWU in 1995, and its total costs to \$90 per SWU. The detailed study of the legislation's potential impact should be completed by the end of 1989. DOE's final costs could be lower if the Administration's bill, once enacted, allows utilities to trade emissions and provides incentives to promote clean coal technology.

Sen. J. Bennett Johnston (D-LA) attached an enrichment plant licensing amendment to a Minnesota Public Lands Bill (HR 2783) which was approved by the full Senate on November 20. The amendment, which the NRC has endorsed, would allow the NRC to license enrichment plants under 10 CFR Parts 40 and 70 rather than under Part 50. Initiated by Louisiana Energy Services (LES), this change allows LES to apply for licensing under the regulations for chemical processing facilities rather than for production (reactor) facilities, which NRC Chairman Carr has said is more appropriate. Harold Arnold, President of LES, indicated the request was made now to ensure predictability in the licensing process and save time and money in the long run. He also noted that potential investors in LES would view the move as increasing the likelihood of success for the venture and facilitate raising capital. The bill must go to conference committee because of amendments from the Senate to the original bill. A staffer from the House Interior Committee expressed some doubts about proceeding in the House with this licensing amendment on a non-related bill. While the licensing amendment is not controversial within the committee, the House may be reluctant to vote on it without a prior hearing. The House could consider it immediately after reconvening, or perhaps include it with more related legislation such as restructuring DOE's enrichment enterprise. However, it is clear that the House has committed to consider this issue early next year.

In an attempt to start the enrichment restructuring bill moving in the House, DOE initiated discussions with Rep. Philip R. Sharp (D-IN), Chairman of the Energy and Power Subcommittee of the House Energy and Commerce Committee, to seek authorization for an independent financial review of the department's enrichment program. After the Committee submitted its input on the

RECENT DEVELOPMENTS***Western Governors'
Association Endorsement***

scope of the study, DOE began seeking consultants for the project. Included in the announcement was a "Program Background", which had not been discussed with the Committee. Rep. Sharp wrote to Deputy Secretary Henson, stating that the Program Background is "nothing more than a rewriting of history, and contains so many false statements, misrepresentations, and biases that I am doubtful that the study could prove to be of any value." He concluded, "I suspect the damage has already been done, and the study will now likely have limited credibility at best." Clearly, DOE has antagonized Rep. Sharp, and the likelihood of an enrichment restructuring bill moving in the House from this committee is now questionable.

At its December 1-3 meeting in Las Vegas, Nevada, the Western Governors' Association (WGA) passed a resolution unanimously supporting Congressional restructuring of DOE's uranium enrichment program, clean-up of mill tailings, and restoration of the uranium mining industry's viability. The WGA also instructed its staff to communicate the text of the resolution to the President, appropriate administrative agencies, and Congressional committees, and to work with the staff to facilitate passage of a bill. This effort by the WGA should create some interest in the House in restructuring uranium enrichment legislation. Seventeen states are members of the WGA.

Another resolution passed at this meeting supported legislative revision to the Mining Law of 1872 as it affects unpatented mining claims. The Mining Law of 1872 regulates all hard rock mineral mining and has never been amended substantially. Congress is currently considering changes to the law.

***Uranium Industry
Viability***

Although the Department of Commerce recently determined that uranium imports are not a threat to national security, twenty-one Senators, including Senators Johnston, Ford, Wirth, McClure and Domenici, sent a letter on November 20 to President Bush which indicated that a viable domestic uranium industry is in the national interest and expressed concern about the rapid demise of the industry. "We urge that you ... commit the Administration to active support of legislation already passed by the Senate to assist the uranium industry and restructure the enrichment enterprise; and that you direct continuing efforts by the Administration to assure the survival of a domestic uranium industry."

***Radionuclide Emissions
Regulations***

Although EPA announced the regulations governing radionuclide emissions by the court ordered deadline of October 31, the rules have not yet been published in the Federal Register. Copies of the rule and some of the supporting documents have been available in the EPA's public document room, but other critical material such as the computer codes COMPLY and COMPLY R, which are essential for determining whether a facility is in compliance, are not yet available to the public. It appears there are differences between parts of the final rule and the proposed rule, but the effect and extent of these differences are difficult to determine until the EPA explains its criteria and implementation. This lack of information on specific standards and their enforcement is the major complaint of the industry thus far. ■

RECENT DEVELOPMENTS

Nuclear Fuel Industry Developments	
November	
3	Louisiana Energy Services (LES) announced that its enrichment plant would be located in Claiborne, Louisiana. Howard Arnold, President of LES said, "Our next step will be to continue further in-depth geological and technical studies and to complete the administrative details of the purchase."
6	Ontario's Energy Minister Lyn McLeod announced that no decisions on new nuclear plants would be made until the next election (1991 or 1992). This statement contradicted an announcement earlier this year in which the provincial government indicated a decision was likely in 1990.
7-11	Namibia held its first free national elections in which the South-West African People's Organization (SWAPO) won 57 percent of the vote. The elections determined how many seats each political party or alliance would hold in a constituent assembly. The assembly has already begun drafting a constitution. (See article on page 13.)
9	UK Energy Secretary John Wakerman announced the exclusion of nuclear energy from the UK's electricity privatization program due to fears that its high costs would deter private investors. In addition, the UK cancelled its plans to construct three PWRs similar to Sizewell-B. (See article on page 13.)
13	The Atomic Safety & Licensing Board found Seabrook's emergency plan "adequate and implementable" and recommended that the Nuclear Regulator Commission (NRC) issue a full-power operating license. The NRC must make a decision within 30 days.
13	It was announced that the Swedish-Swiss electrical supply giant ABB Asea Brown Boveri Ltd. would purchase Combustion Engineering (CE) for US\$40 per share, or approximately \$1.6 billion. The merger will enable ABB to improve its presence in the USA and will provide CE additional financial and technical backing. Sales of both companies in 1988 totalled approximately \$7 billion in the USA. (See article on page 14.)
20	Umetco Minerals announced a cutback in its uranium and vanadium mining activities in Western Colorado as well as its Eastern Utah milling operations due to deteriorating market conditions. Umetco produced about 650 thousand pounds U ₃ O ₈ in 1988, and is estimated to have about four million pounds stockpiled.
20	Canada and the Soviet Union agreed to cooperate in nuclear technology development , uranium exploration and development, and other peaceful uses of nuclear energy.
28	DOE announced a seven-year delay in the operation of a permanent nuclear fuel waste repository to 2010, provided the repository's linkage with an MRS is severed. DOE also plans to sue the State of Nevada, which has refused to allow testing at the proposed repository site.
28	British Nuclear Fuels Ltd. (BNFL) announced it would establish a US subsidiary to vie for clean-up work at DOE's nuclear sites and to offer assistance in nuclear plant decommissioning. BNFL believes it can compete successfully in the USA because no US firm offers the same experience or services.

1989 PRELIMINARY MARKET REVIEW

Amid falling uranium prices and the liquidation of excess inventories, a buyers' market has influenced current contracting practices. More and more sales are occurring in the spot market, as buyers seek to take advantage of historically low prices. The duration of long-term contracts continues to shorten, and many contain some form of market related pricing. The effects of these trends are evident from NUEXCO's transaction data, some of which is summarized below. In this preliminary review of our 1989 market data, we concentrate on spot market activity, as well as several political developments that may affect the market in the longer term.

Uranium Spot Market Activity

With only a month remaining in 1989, sales volume in this year's uranium spot market has already reached a record high. Through November 30, spot market volume totalled over 20 million pounds U₃O₈ equivalent in 90 transactions. This is the highest level of sales since NUEXCO first began reporting transaction data in 1981. Last year NUEXCO reported 81 spot market sales involving a total of 14.6 million pounds, while in 1987 approximately 19.9 million pounds were sold in 85 sales.

The Exchange Value fell steadily throughout 1989, from \$11.75 at December 31, 1988, to \$9.20 eleven months later, a 22-percent drop in then-current dollars. The UF₆ Value also declined 22 percent, from \$35.50 at December 31, 1988, to \$27.75 at November 30, 1989. Aggressive sellers and the lack of firm demand accounted for much of the downward pressure on prices. Many buyers, sensing the possibility of continued price weakness, postponed purchasing until firm needs had to be met. Buying on the spot market for current demand has become an accepted practice with utility buyers. An increasing number of producers elected to purchase uranium to meet some of their supply commitments rather than produce, for at current spot price levels, few producers are able to cover their production costs. In fact, four US mines have announced shutdowns this year, in addition to the four South African mines which ceased uranium recovery operations in 1988.

In early 1989, two political and legal developments, though not unexpected, dealt twin blows to US uranium producers. The enactment on January 1 of the US/Canada Free Trade Agreement effectively gave Canadian uranium domestic status in the USA. This agreement also made moot the four-year-old US Producers' lawsuit against DOE, and on January 27, the Plaintiff ended legal proceedings. Together, these events essentially eliminated any near-term prospect of a significant premium for US-origin uranium. US producers and other holders of excess US-origin material then began to sell off stocks that had been acquired in anticipation of favorable judicial or legislative actions. Legislation identical to that proposed in 1988 again was introduced into Congress, but without success. Those hoping for legislative assistance soon joined other sellers of US-origin inventory.

Throughout the year, many market participants wondered where the seemingly unending supply was coming from. The liquidation of excess inventories provided much of the material, as did numerous loans which served to reposition existing stockpiles. Such transactions created the appearance of substantially larger supplies.

Chinese and Soviet suppliers offering competitive material also contributed to the oversupply. During the first half of the year, Chinese Nuclear Energy Industry Corporation (CNEIC) aggressively sought to expand its market share. However, as prices dropped below \$11, it appeared to withdraw, indicating a reluctance to participate at lower price levels. Uranium from the Soviet Union also came into the market via sales of enriched uranium product, primarily in Europe. To offer potential customers more assurance about reliability of supply, both Chinese and Soviet suppliers stockpiled material in the USA during the year.

The liquidation of the West German uranium stockpile by the Federal Ministry of Research & Technology (BMFT), a long-standing concern of DOE and uranium producers, began in 1989. The government sold approximately 2.7 million pounds U₃O₈ equivalent of its "offset" material, which was originally purchased in the 1970s to help offset the costs of maintaining US troops on West German soil. Concerns that such a large quantity of material would flood

ANALYSIS & COMMENTARY

the market appeared to trigger a further round of price declines. Then, after the transaction's psychological impact had been absorbed, actual sales of the BMFT material, at extremely aggressive prices, exerted additional downward pressure on the market.

Developments Affecting the Long-Term Market

Two significant developments in 1989 will have long-term implications for the market:

- changes in the Australian government's floor price policy;
- the impending removal of sanctions against Namibian uranium.

Although the Australian government announced plans to review its three-mine and floor price policies in 1989, no formal revisions can be expected until mid-1990. However, by approving the renewal of long-term contracts this year at \$26 per pound U_3O_8 —\$5 less than the official floor price—it effected a *de facto* floor price change. In addition, Primary Industries and Energy Minister John Kerin stated that the floor price in *new contracts* would be determined at a level which reflected the national interest in particular circumstances and the market conditions in which the contracts are negotiated. No doubt, the difficulties ERA had with its contract renegotiations in 1989 were, in some measure, responsible for these actions. As a result of this change, Australia's presence in the long-term market can be expected to increase.

The possibility of lifting *de facto* and *de jure* sanctions against Namibian uranium also attracted much attention in 1989. An agreement signed early in 1989 among South Africa, Angola, and Cuba initiated the Namibian independence process. Following Namibia's November election of its first constituent assembly, the United Nations declared the elections free and fair. As a result, anti-apartheid sanctions against Namibia will likely be removed in early 1990. This will enable Namibia's Rössing mine, a major contributor to the country's GNP, to compete freely on the world market. Although the potential change in Namibia's political status did not directly affect the uranium market in 1989, the availability of Namibian-origin material could increase competition next year for those opportunities involving purchasers who were previously barred from buying Namibian uranium.

Loans

Loan material was readily available during the year, and NUEXCO's preliminary estimate indicates that 16 natural uranium loans involving 8.3 million pounds U_3O_8 equivalent took place through November 30. All types of market participants, both US and European, loaned or borrowed material. Lenders were typically utilities, while traders and producers borrowed the bulk of material. Loans resulted in the existing stockpiles being repositioned, augmenting the ample supplies of uranium available from other sources. The Loan Rate remained at 3.5 percent per annum throughout the year.

Conversion

The conversion market remained stable over most of 1989, although increased competition among the primary converters in the spot market as well as large supplies of UF_6 arising from the partial liquidation of the West German government uranium stockpile and other sources, placed growing pressure on spot prices towards year-end. As primary converters became more active in the secondary market, the distinction between primary and secondary markets blurred. The Conversion Value declined from \$1.95 at December 31, 1988 to \$1.75 at November 30, 1989. NUEXCO has reported 14 conversion transactions during the first eleven months of 1989, involving almost 6.2 million pounds U as UF_6 .

Enrichment

The SWU price dropped by approximately twelve percent during 1989 in then-current dollars, from \$65 at December 31, 1988, to \$57 at the end of November. Utilities purchasing spot market SWU fostered very aggressive competition among suppliers. Multiple bidders, low prices, and extremely favorable terms characterized most of the SWU sales in 1989. The West German stockpile material, which was sold at progressively lower prices, had an important role in most SWU sales that occurred later in the year. NUEXCO reports seven enrichment transactions through November 1989, involving a total of more than one million SWU. ■

VOLATILITY OF MINERAL PRICES

In recent years, the term "volatile" has been linked more and more frequently to uranium prices. Certainly, uranium prices have changed substantially over the past decade, and in recent months the spot market price has dipped to record lows. The question arises, however, as to whether or not such changes are unusual in terms of natural resources, or whether other mineral commodities also exhibit significant price changes.

NUEXCO maintains ongoing price files for many natural resources. This data provides some perspective for comparing price changes in uranium with those in other minerals. In order to develop a basis for comparison, the

study period has been limited to post-World War II, and prices as well as price changes have been calculated in constant 1988 US dollars. All prices relate to US deliveries and sales.

Table 1 summarizes certain of the price characteristics of various natural resource commodities. Average annual constant-dollar prices as well as the magnitudes of annual price variations are illustrated graphically on the following pages. Both the table and the graphs seem to indicate that uranium prices do not exhibit unusual volatility. Indeed, most of these commodities seem to have suffered through several periods of rapid price change.

TABLE 1
PRICE CHARACTERISTICS OF
NATURAL RESOURCE COMMODITIES (1948-1988)

Commodity	Average Constant Dollar Price ¹	Current Price ²	Standard Deviation of Annual Prices	Standard Deviation (Percent) ³	Maximum Annual Price Volatility	Average Annual Price Volatility
Aluminum (lb)	0.77	0.83	0.10	13%	46%	7.4%
Coal (ton)	21.37	22.00 ⁴	6.48	30%	55%	5.5%
Copper (lb)	1.09	1.39	0.24	22%	41%	10.7%
Gold (troy oz) ⁵	319.40	360.30	151.10	47%	71%	22.5%
Lead (lb)	0.44	0.41	0.11	25%	39%	13.8%
Mercury (flask)	697.16	262.50	427.89	61%	132%	20.2%
Molybdenum (lb)	4.88	3.43	2.15	44%	97%	10.2%
Petroleum (bbl)	13.42	16.40 ⁶	6.62	49%	50%	9.2%
Silver (troy oz)	6.05	5.11	4.07	67%	82%	16.0%
Tin (lb)	5.19	3.98	1.95	38%	46%	11.1%
Uranium (lb)	31.70	9.40	14.24	45%	97%	13.6%
Vanadium (lb)	7.85	4.95	1.32	17%	73%	11.1%
Zinc (lb)	0.48	0.84	0.09	19%	46%	10.8%

¹ 1988 US dollars

² August 1989

³ Percent of average constant dollars prices

⁴ Preliminary 1988 average

⁵ All gold price characteristics are based on the period 1968-1988 in which gold prices have been decontrolled.

⁶ June 1989

ANALYSIS & COMMENTARY

Precious Metals

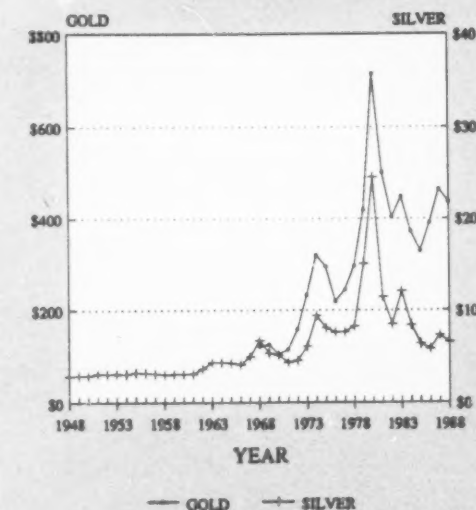
In recent years, gold and silver prices have been characterized by substantial volatility. Speculation, interest rates, oil prices, inflation, and international tensions all seem to have had their impact.

Record high silver prices occurred in 1980 in response to the Hunt Brothers' attempt to corner the silver market. However, volatile silver prices are not just a recent phenomenon. The silver boom and bust years of the late 1800s were replete with many sagas of the rise and fall of the silver barons, including Colorado's Horace Tabor and his celebrated bride Baby Doe.

From 1792 to 1968, the US Government supported stable gold prices through a stockpiling program of the US Treasury. Since 1968, however, gold prices have been allowed to seek market levels. Gold prices also hit record highs in 1980 as the speculative fever for silver carried over into other precious metals. High gold prices have encouraged a rapid increase in gold production (more than 50 percent since 1982). It will be interesting to follow near-term gold prices to see how they are affected by this increased production.

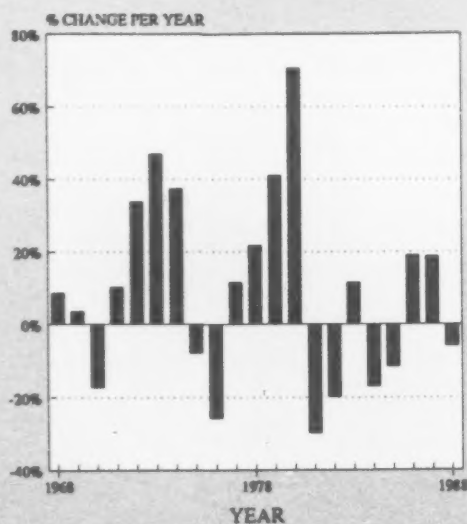
PRECIOUS METALS

**GOLD & SILVER
HISTORICAL PRICES**



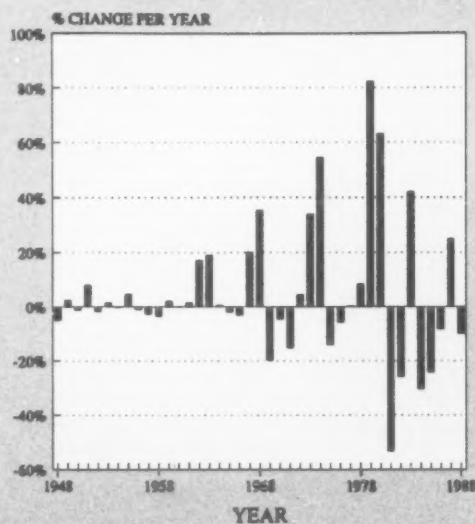
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**GOLD
PRICE VOLATILITY**



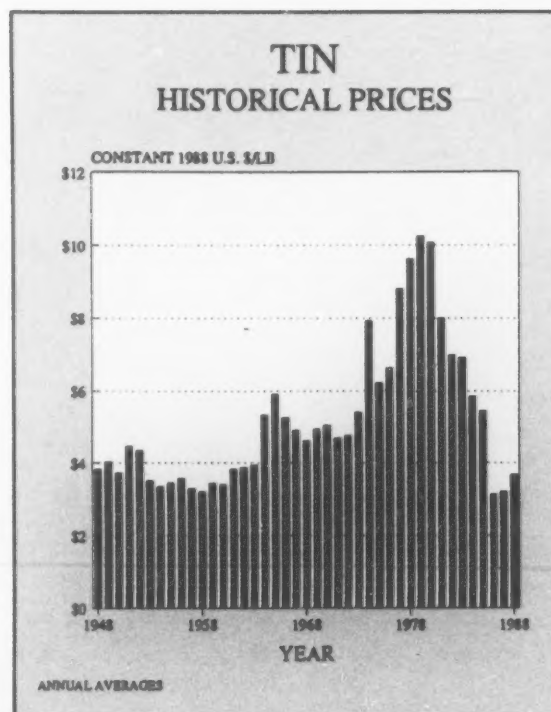
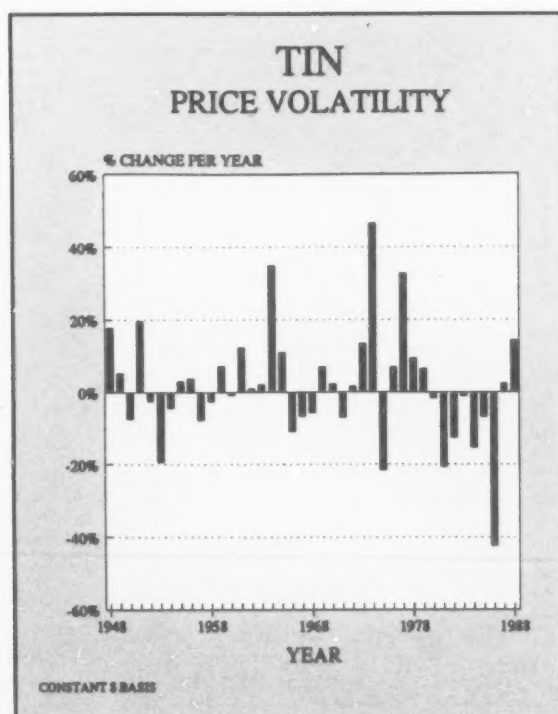
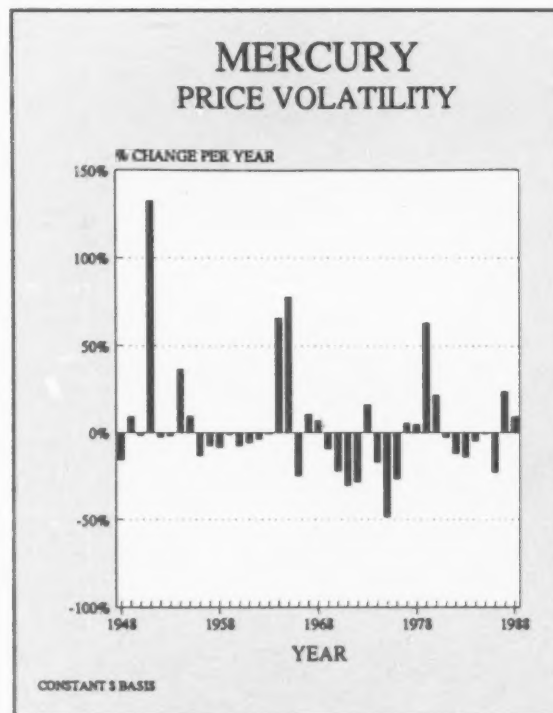
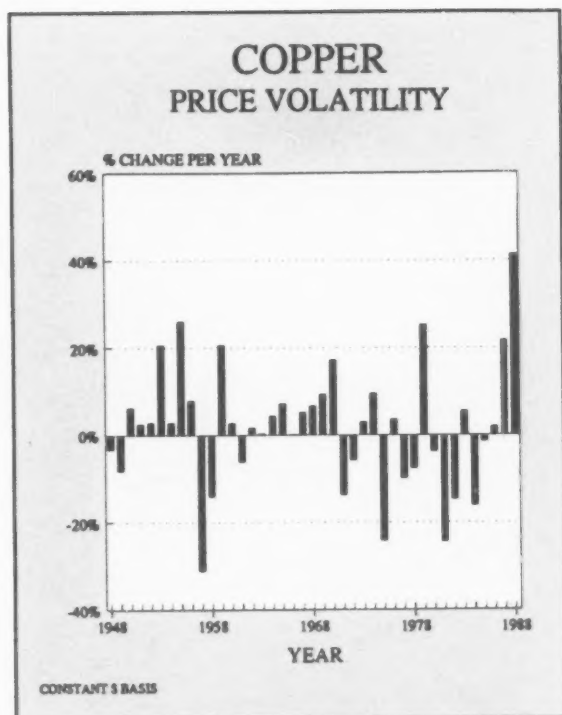
CONSTANT \$ BASIS

**SILVER
PRICE VOLATILITY**

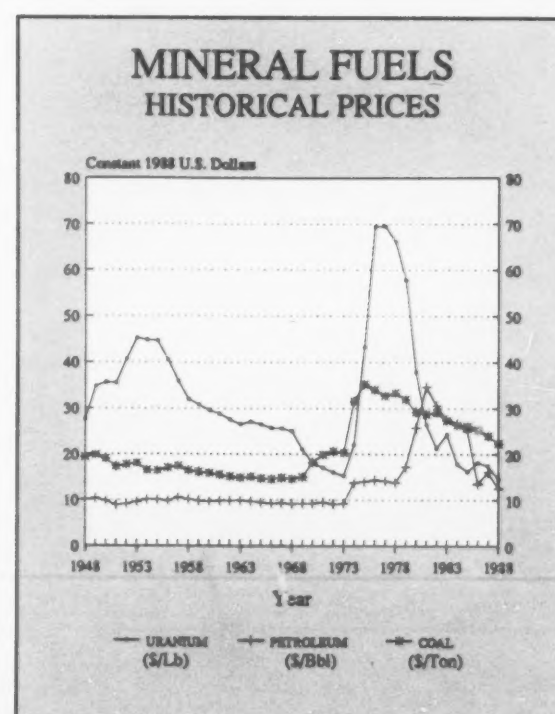
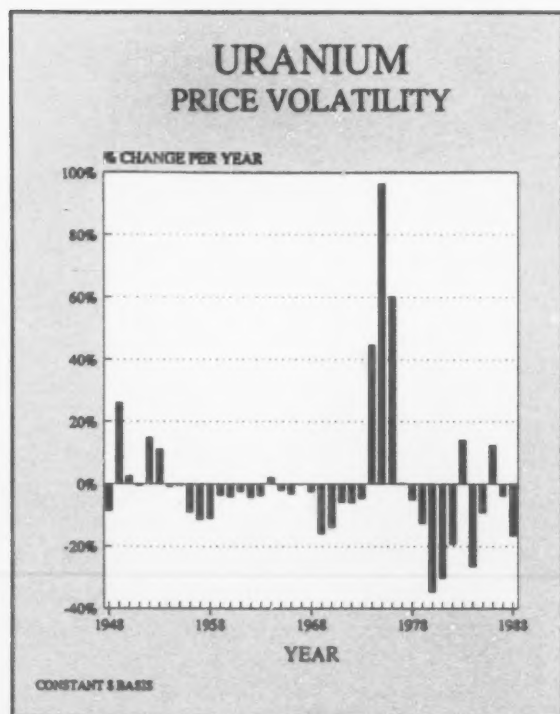
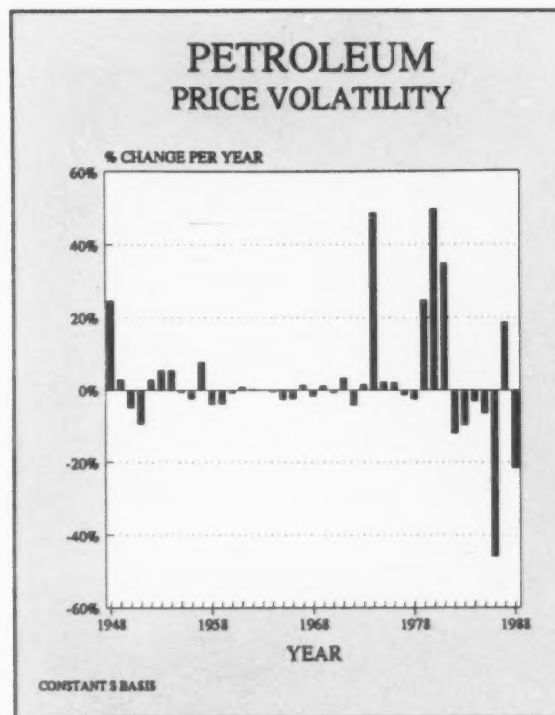
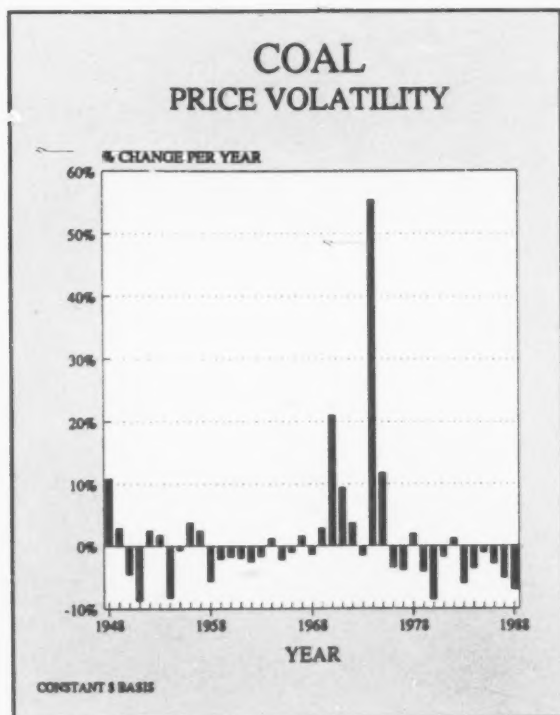


CONSTANT \$ BASIS

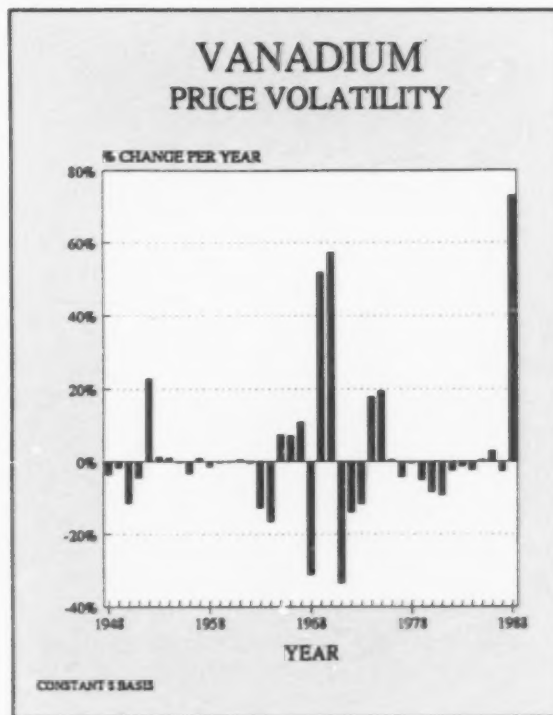
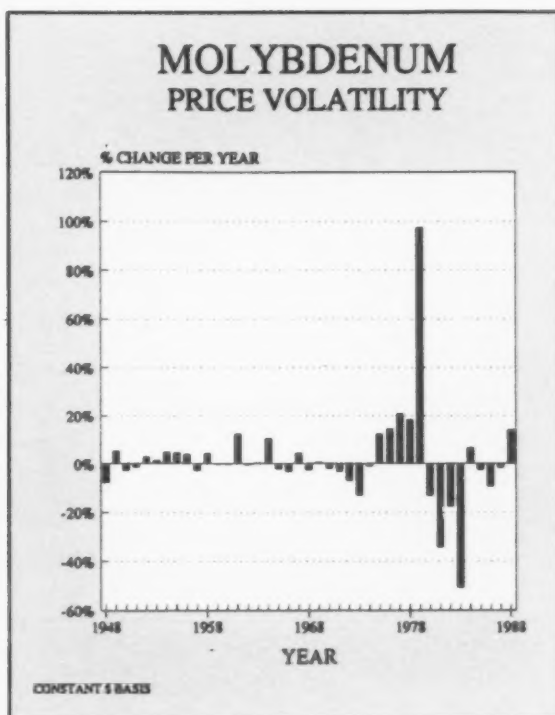
BASE METALS



MINERAL FUELS



SPECIALTY METALS



Base Metals

Base metals such as aluminum, copper, lead, mercury, tin, and zinc have all experienced rapid changes in price during the past four decades. Prices for most of these commodities were notably low in the mid-1980s, but substantial recoveries have been made in the last two years.

Lead and mercury prices have suffered substantially from health-related concerns and have limited demand.

Tin prices provide an interesting story of the rise and fall of a "controlled" market. The International Tin Council (ITC) was formed among producing and consuming nations in 1956 to stabilize prices through controlled production and stockpiling activities. These efforts rewarded the producers with increasing real prices through the early 1980s. High prices, however, caused decreased demand, and the tin market collapsed in 1986.

Mineral Fuels

NUEXCO's readership needs little explanation of the price trends for mineral fuels or the reason for those trends.

It is interesting to note, however, the similarities between coal, petroleum and uranium price movements.

Specialty Metals

Specialty metals such as molybdenum and vanadium tend to have narrow markets which are highly dependent upon a specific industry such as steel. In addition, production may be concentrated among only a few producers. This concentration has tended to provide for relatively stable prices through the years.

Molybdenum prices, for example, were exceptionally stable through the mid-1970s as the Climax Molybdenum Co. completely dominated world production. Increasing competition in the late 1970s seems, however, to have destabilized prices.

Tom C. Pool
NUEXCO Information Services

RAW MATERIALS

RESTRUCTURING OF THE URANIUM PRODUCTION INDUSTRY

Introduction

The restructuring of the uranium production industry began in response to persistently low spot market prices and continues due to expectations that market conditions will remain depressed in the foreseeable future. This situation has affected even those producers who neither participate in the spot market nor incorporate spot market prices into their long-term uranium sales agreements, because long-term market prices have declined as well.

Utility consumers of uranium are focusing less on the issue of supply reliability and increasingly upon the direct cost of the product, a trend that began in the USA and has extended in recent years throughout the world. As prices have collapsed, utilities worldwide are giving more serious consideration to the spot market and are purchasing material for near-term delivery and, to varying degrees, using spot market price references in their multi-year supply agreements.

The much-publicized Japanese utility-US producer long-term uranium supply agreements executed in the past two years generally take into account the spot market price in determining the contractual delivery price. This is clearly a departure from the pricing provisions in uranium supply agreements entered into by Japanese utilities in the 1970s and early 1980s.

How are uranium producers responding to these changing conditions? This article focuses on the current production situation by country and the factors that may prove important in determining future capacity and output.

Australia

In 1989, industry attention focused on the *de facto* revision of the official US\$31 per pound U₃O₈ Australian floor price. On September 4, Primary Industries and Energy Minister, John Kerin, announced governmental approval of Energy Resources of Australia's (ERA) negotiated agreements with its equity shareholder/customers. What was surprising, however, was that the Hawke government approved prices at \$US26.00 per pound U₃O₈. Of greatest importance was Kerin's statement that, "When considering new contracts

concluded by Australian producers, the floor will be determined at a level which reflected the national interest in particular circumstances and market conditions in which the contracts are negotiated." The Minister added, "I will need to be satisfied that prices producers have concluded are, at least, comparable with those being received by others in the market."

The "three mine policy", which currently allows uranium exports via letters of determination from only three mines—Ranger (ERA), Olympic Dam (Western Mining/BP Minerals), and Nabarlek (Queensland Mines), continues as the major unresolved political matter. However, ERA has announced that its planned expansion program has been deferred due to market conditions. However, Australian uranium production appears to be proceeding at a relatively stable rate as the start-up of Olympic Dam offsets the exhaustion of Nabarlek's original reserves.

Canada

The US-Canada Free Trade Agreement has substantially reduced the differences between uranium concentrates of Canadian and US origin. The term "North American origin" has come into common use throughout the nuclear fuel market.

Clearly, uranium market conditions are exerting a strong influence on decision-making within the Canadian uranium production industry. Early this year, Cameco announced that Rabbit Lake operations would be shut down on July 1 for at least six months. The company specifically cited market conditions as the primary decision factor. Later, Cameco announced the shutdown of Cluff Lake operations for at least six months, once again citing depressed market conditions. Key Lake continues to operate at or near capacity.

There is widespread uncertainty involving several announced new uranium properties in Western Canada (Northwest Territories/Saskatchewan) including Cigar Lake, Midwest Joint Venture, Dawn Lake, McClean Lake, and Kiggavik. The inability to secure long-term uranium sales agreements which provide for acceptable market risk

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to the producer and allow for project financing will definitely hinder the development of these projects.

The Elliot Lake operations of Denison Mines Ltd. and Rio Algom Ltd. continue to respond to market conditions through improved efficiency and cost-cutting programs. Moreover, these producers entered into long-term uranium supply agreements during the mid-to-late 1970s which have provided for relatively stable pricing and profitability. Once again, the future of these operations will become an increasingly important issue as some of these agreements expire or become eligible for cancellation in the early 1990s.

Namibia

The recent free elections held in Namibia represent a milestone for that country as well as the future of the Rössing mine. The South-West African People's Organization (SWAPO) attained a 57-percent majority, but failed to garner the necessary two-thirds majority to allow that group to develop its own constitution. Consequently, a multi-party government will likely determine the future course of Namibia.

Rössing, one of the world's largest uranium producers, has continued to operate at a high capacity level in spite of the increasingly restrictive trade sanctions against materials from South Africa and Namibia. With the advent of Namibian independence, government sanctions related to apartheid should be lifted by early 1990. This will allow Rössing origin material to enter the marketplace on an equal footing with its competitors. In fact, some countries may even exhibit a preference for Namibian material as a demonstration of support for the new government.

South Africa

Uranium production from the gold mines of South Africa has fallen precipitously over the past several years. As economic sanctions have taken effect and market prices declined, the NUFECOR producers have reacted by shutting in uranium production and, in some cases, converting uranium recovery facilities to gold recovery.

Uranium concentrates production fell from almost 15 million pounds U_3O_8 as recently as 1984, to less than ten million pounds U_3O_8 in 1988. Production through the first nine months of 1989 approximated 5.5 million pounds U_3O_8 , suggesting that total production for 1989 should fall in the range of 7 to 7.5 million pounds U_3O_8 . Additional

reductions might take place in the near-term as the South African producers struggle with the current political and economic uncertainties.

France and Central Africa

The close ties between Cogema, the French government, and the former French colonies of Niger and Gabon have served to provide some degree of insulation between French uranium interests and market forces. That insulation is under increasing pressure, however, as world prices drop further below French production costs.

In late 1988, Cogema announced a staff reduction at its domestic uranium production operations. This was the first such reduction in its history. Gabonese production is running at about 50 percent of capacity, and operations in Niger have recently been shifted to economically more favorable deposits.

China and the Soviet Union

The recent entry of China and the USSR into the world nuclear fuel market puts increasing pressure on western producers, as both countries have substantial uranium production capabilities. Much of China's past production has been dedicated to military use, but recent announcements indicate that the future focus will be on nuclear fuel. The USSR has produced large quantities of uranium for both military and civilian use. A recent decrease in the rate of expansion of its nuclear program, however, has not yet been reflected in reduced uranium production either domestically or in the other Warsaw Pact countries. Thus, both China and the USSR have production surpluses which are beginning to enter the world market, and which will, at least in the near term, contribute to an already oversupplied market.

United States

According to the Energy Information Administration (EIA), the deterioration of the US uranium production industry has abated over the past couple of years. Annual production levels exhibited some stability in the 12-13 million pound per year range, while industry employment actually increased slightly in 1988. New production facilities were developed (Highland Uranium Project, Kingsville Dome, Rhode Ranch) and producers reported economic reserves of more than 300 million pounds U_3O_8 .

RAW MATERIALS

RECENT PRODUCTION SUSPENSIONS	
1988	1989
Harmony—South Africa	Mt. Taylor (Chevron)—USA
Stilfontein—South Africa	Sunshine Bridge (Freeport)—USA
Driefontein—South Africa	Grants, New Mexico (Homestake)—USA
Randfontein—South Africa	Kingsville Dome (URI)—USA
Lucky Mc (Pathfinder)—USA	Rabbit Lake (Cameco)—Canada
Lisbon (Rio Algom)—USA	Cluff Lake (AMOK)—Canada

The Secretary of Energy has found the industry to be "non-viable" for four consecutive years (1984-1987).

In September 1989, the US Department of Commerce found that uranium imports did not present a threat to national security and, in fact, the US-Japanese uranium sales agreements suggested an industry able to compete in the international marketplace. Nevertheless, additional production center closures have dominated the US industry since mid-year.

Uranium Resources, Inc. (URI) announced that Kingsville Dome would be shut down indefinitely because it was more economically advantageous to purchase necessary concentrates on the spot market than to produce. Chevron Resources made the decision to shut down Mr. Taylor in the event that an equity partner or buyer could not be located by the end of this year. Freeport Uranium Recovery Corporation (FURC) shut down the primary recovery circuit located at the Sunshine Bridge (Donaldsonville), Louisiana plant in response to continuing depressed spot market prices. Homestake Mining will no longer produce at its New Mexico mines and plans to shut the Grants Mill in response to the Mt Taylor closure. Those four shutdowns (assuming Mt. Taylor is closed) may account for an annual loss of production totalling more than 3.5 million pounds U₃O₈.

What is significant about all of these announcements is that these decisions affect uranium production facilities

which have production costs at or below \$20/pound U₃O₈. No longer does one see the closure of high-cost production facilities. Those facilities (especially in the USA) have already been closed and, in some cases, dismantled. Now the nuclear industry is witnessing the shutdown of the "cheap" production sources. No longer is viability the goal, *survival* has become the overriding concern.

The ability of US industry to survive is somewhat unchanged by the wide range of production facilities currently in operation: solution mining (in-situ leaching) and by-product operations in addition to conventional open pit and underground mines.

In order to overcome historically depressed prices and the emergence of aggressive foreign competition, a segment of the US uranium production industry opted to pursue the commercialization of solution mining technology. Companies such as Atlantic Richfield, US Steel, Everest Minerals, Uranium Resources, Mobil, Wyoming Minerals, Intercontinental Energy Corporation, UNC/Teton, Tenneco Minerals, Sequoyah Fuels and Uranerz, USA spearheaded the drive into this newly-emerging technology.

Solution mining is playing an increasingly important role in the USA. During 1988, uranium produced from solution mining technology accounted for almost 19 percent of the US total. The reactivation of the Irigaray Project (Malapai Resources) coupled with the commercial start-up of the Highland Uranium Project (Everest Minerals/Interuran)

RAW MATERIALS

and the Kingsville Dome Project (Uranium Resources, Inc.) accounted for almost 1.9 million pounds of total US production. Production costs for the most efficient solution mining projects are generally less than \$15.00 per pound U_3O_8 . Based upon the current outlook for uranium market conditions, production facilities based upon in-situ leaching technology are likely to play an even greater role in the future.

By-product recovery from phosphoric acid, another non-conventional uranium production technology, has proven to be commercially viable. International Minerals & Chemicals (now IMC Fertilizer) and FURC secured long-term sales agreements and constructed their uranium recovery circuits at their phosphoric acid plants in the late 1970s and early 1980s. Production steadily increased and reached approximately 3.3 million pounds U_3O_8 during 1988. The annual production stream from the two phosphoric acid by-product producers has remained relatively stable over the past several years. FURC's announced shutdown of the Donaldsonville facility will have only a minimal impact on 1989 production levels, which should exceed three million pounds U_3O_8 . However, phosphoric acid by-product production will likely fall below that level in 1990.

Uranium production from conventional sources does play an important role in the USA. The Rhode Ranch project entered commercial operation in 1988 and has proven to be a cost-competitive production center. Unfortunately, the ore reserves have a limited life and will be mined out by 1992-1993. Development of the breccia pipes in Northern Arizona has been reduced in response to spot market prices, but production is being sustained. However, it is

likely that production will decline as some of the operating mines reach the end of their economic life.

All in all, US production will likely decrease in the near future as producers shut down mines and purchase necessary concentrates in the open market. There is scant incentive to produce material when the option of purchasing the pounds remains economically attractive.

Conclusion

The Western world's uranium production industry is under severe stress. Virtually all uranium producers are feeling the effects of chronically depressed market prices, and the concept of "viability" has been replaced by "survivability" for a number of producers. Historically low market prices (in real terms), which have persisted for the past several years, have had and will continue to have an impact not only on existing operations, but also on the development of new production centers, particularly in North America.

There appears to be no easy answer to the situation. As long as utility buyers desire to directly link prices under multi-year supply agreements with the spot market price, and potential suppliers respond to those customer requirements, then the industry will not recover until spot market conditions improve. Only time will tell whether this condition is healthy for the industry as a whole, or if it will lead to future market volatility due to uncertain uranium production.

Dustin J. Garrow
NUEXCO Trading Corporation



HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	

HISTORICAL US PREMIUM (Relative to the Exchange Value)												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	None	

HISTORICAL UF ₆ VALUES												
Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	

HISTORICAL MARKET DATA
HISTORICAL US UF₆ PREMIUM (Relative to the UF₆ Value)
Determined as of the last day of the month indicated (\$US/kg U as UF₆)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	None	

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (\$US/lb U₃O₈)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (\$US/lb U as UF₆)

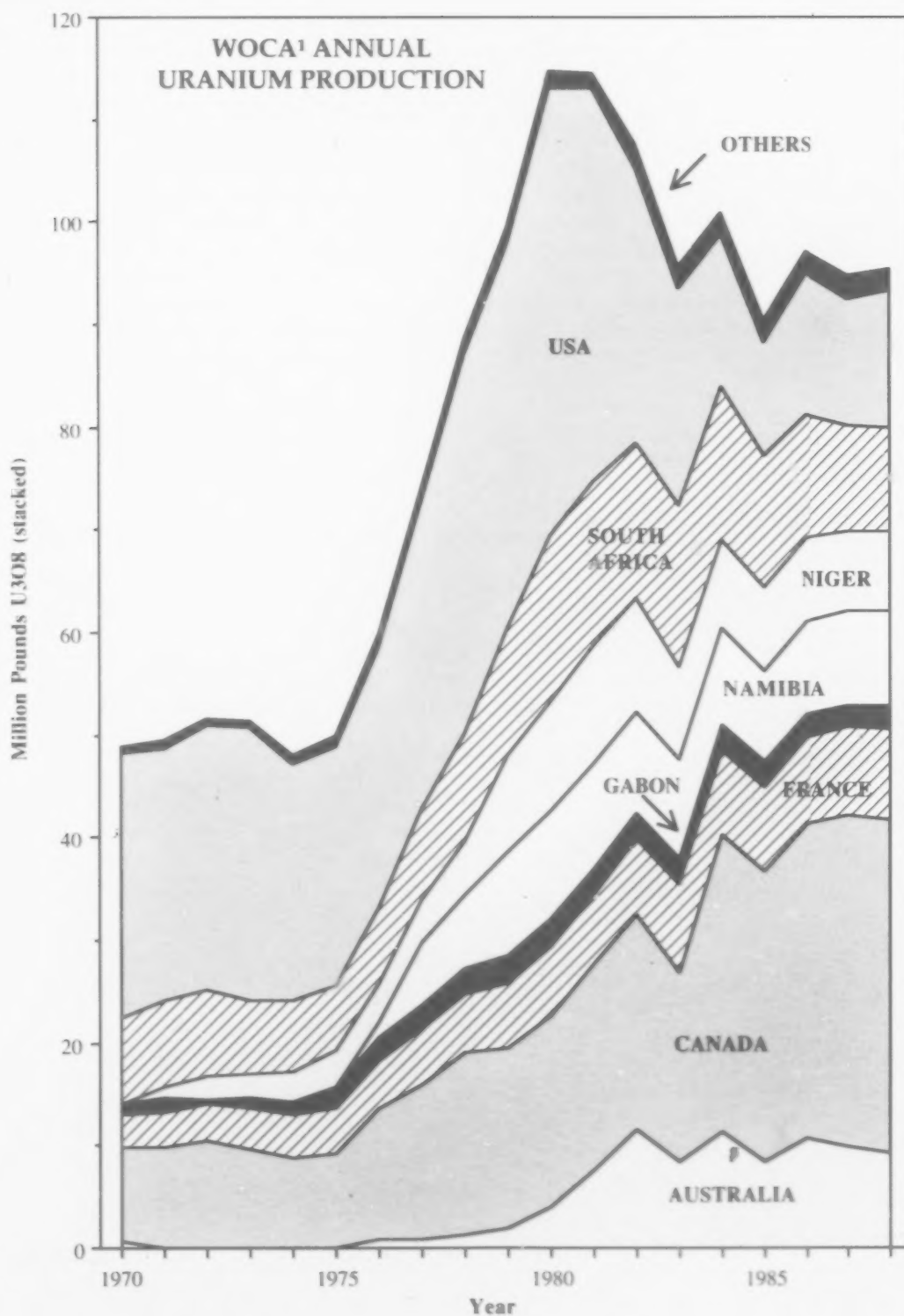
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	

HISTORICAL SWU VALUES (at 0.30 Percent Tails Assay)

Determined as of the last day of the month indicated (\$US per SWU)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	

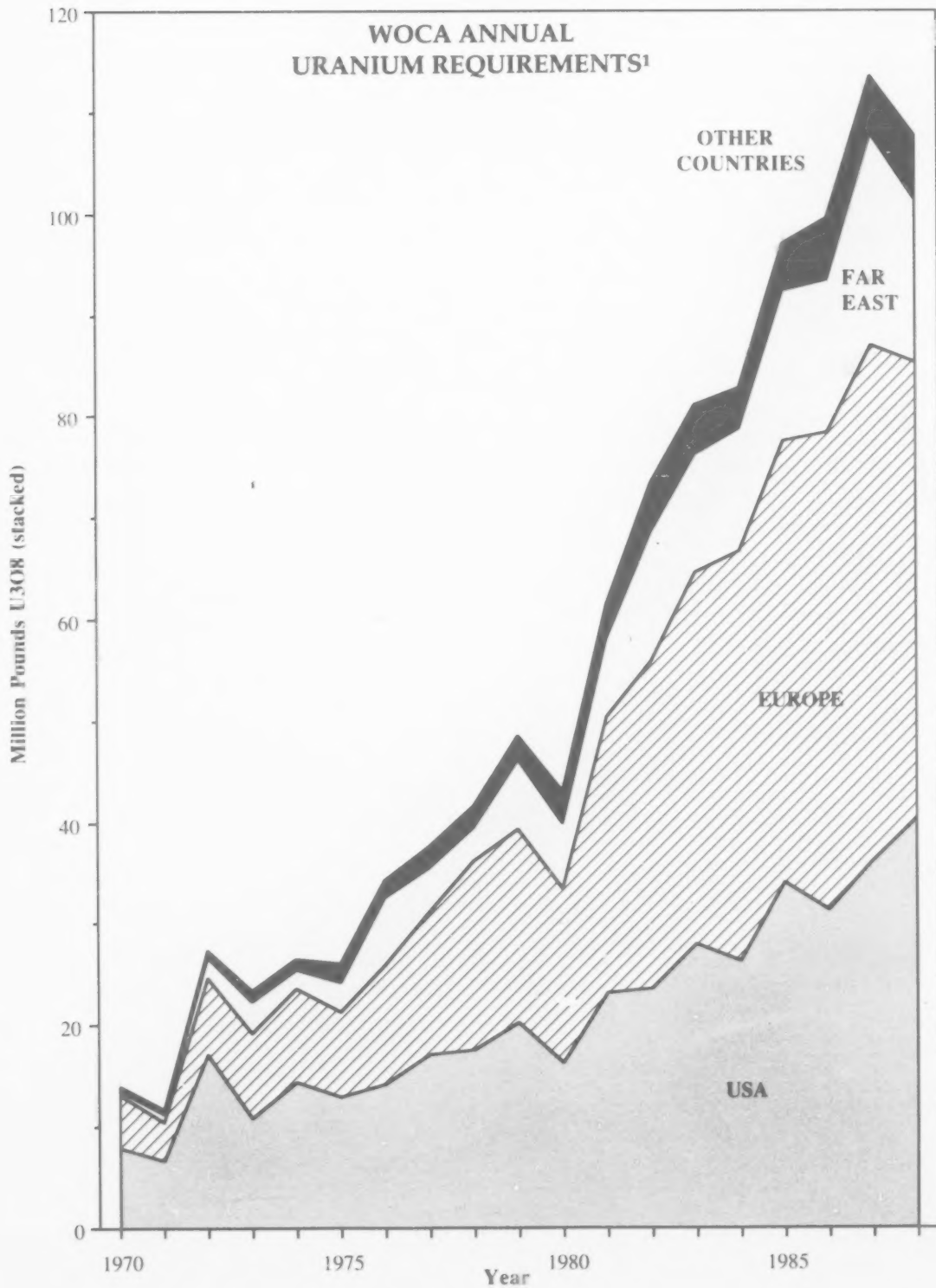
HISTORICAL MARKET DATA



¹ WOCA = World Outside of Centrally-Planned Economic Areas.

² World production in 1988 totalled 96.8 million pounds (Australia—9.3; Canada—32.3; France—8.9; Gabon—2.4; Namibia—9.2; Niger—7.8; South Africa—9.9; USA—13.5; Other—3.5).

HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual plant completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

HISTORICAL MARKET DATA

**VOLUME AND PRICE OF URANIUM DELIVERIES
TO THE EUROPEAN COMMUNITY¹**
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC ² (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ^{3,4}		Spot Contracts ^{3,4}	
			Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈	Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,500	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65R	\$16.13R

R = Revised

¹The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

²The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

⁴Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

HISTORICAL MARKET DATA

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	16.10	3.6	n/a	1.2
1977	29.9	27.8	19.75	5.6	n/a	4.0
1978	37.0	31.6	21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

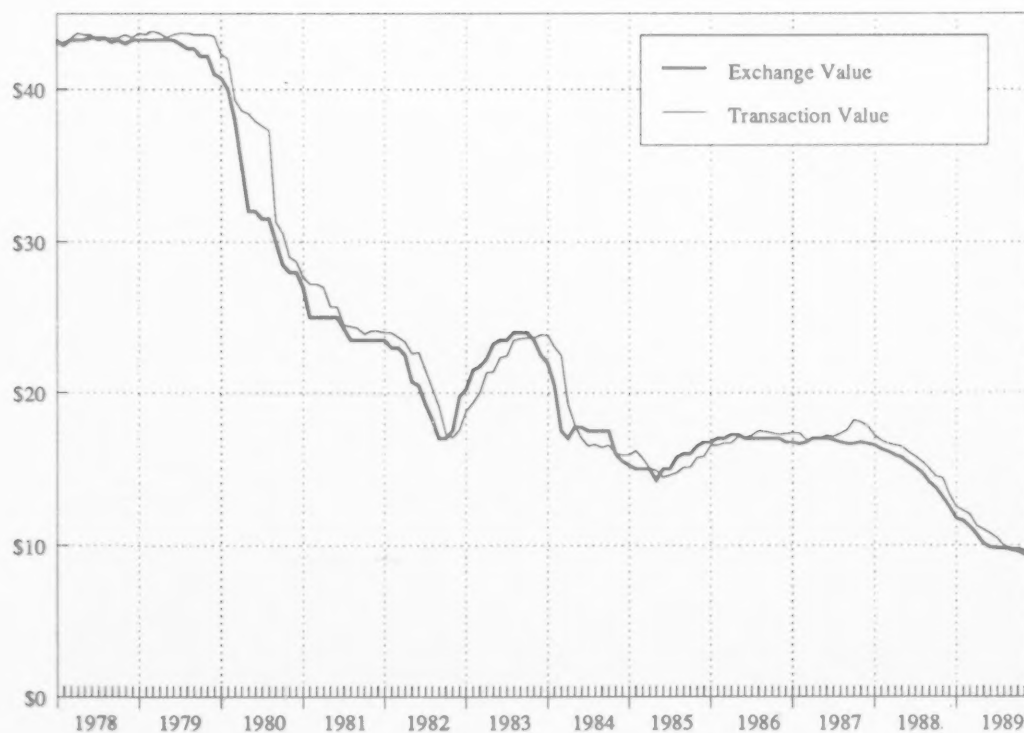
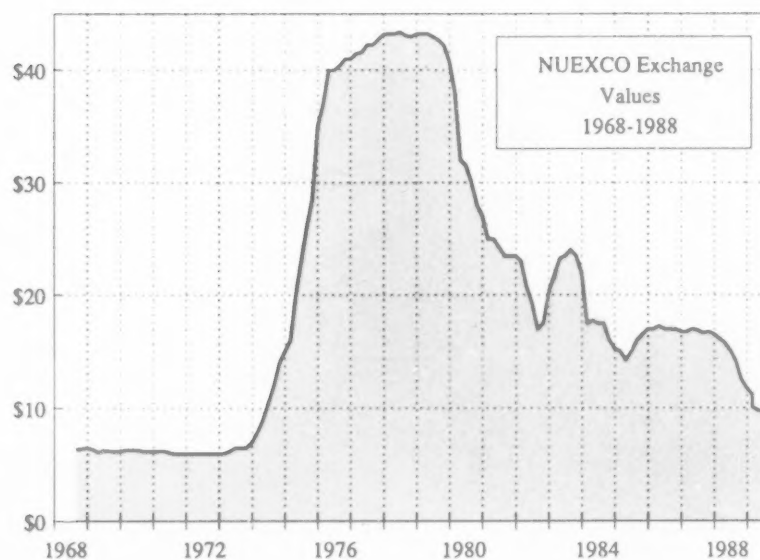
¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agents

³ Includes imports by domestic utilities and domestic suppliers

HISTORICAL MARKET DATA

**NUEXCO Historical
Exchange and
Transaction Values**
(In US Dollars/Pound U.O.)



GOVERNMENT STATISTICS

AUSTRALIA					
		Consumer Price Index ¹ (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ² (1984/1985 = 100)	Average Weekly Earnings — Adult Males — Australia (Australian dollars) ⁶	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates ³ (June 1985=100)
1980	Avg.	95.8	83.1	—	140.8 ^s
1981	Avg.	105.0	85.9	—	154.1 ^s
1982	Avg.	116.7	89.0	—	174.9 ^s
1983	Avg.	128.5	96.9	—	181.9 ^s
1984	Avg.	133.6	98.0	—	194.4 ^s
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
Jan	1989	—	110.6	—	122.2
Feb	1989	—	111.2	521.90	122.2
Mar	1989	188.1R	114.9	—	123.1
Apr	1989	—	117.5	—	123.2
May	1989	—	118.6	531.50P	123.6
June	1989	192.8	119.9	—	123.6
July	1989	—	120.1	—	123.6
Aug	1989	—	119.2	—	—
Sept	1989	197.2	—	—	—

P = Preliminary R = Revised since last month

¹Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

²Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

³Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

⁴Monthly data for the period 1967 to 1986 appear in Report 233.

⁵Base: June 1976 = 100.

⁶Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

GOVERNMENT STATISTICS

CANADA								
Wage-earner Data: Average Hourly Earnings (C\$) ²								
		Industrial Products Price Index: All Commodities ¹ (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells ³ (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	138.2	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	143.8	20.91	18.51	16.95	13.17	13.77
Jan	1989	130.7	146.8	21.22	19.45	18.14	13.75	13.82
Feb	1989	130.8	147.8	22.05	19.51	18.26	13.79	13.89
Mar	1989	131.3	148.5	21.90	19.65	18.35	13.62	14.10
Apr	1989	131.3	149.0	22.37	19.80	18.40	13.57	14.16
May	1989	131.4	150.5	21.89	20.02	18.17	13.76	14.27
June	1989	131.4	151.3	21.89	20.02	18.17	13.76	13.22
July	1989	131.3	152.3	21.67	19.60	17.96	13.57	12.98
Aug	1989	131.2	152.4	20.97	19.76R	18.24R	13.52R	14.30R
Sept	1989	130.9	152.6	21.97P	20.60P	18.73P	13.60P	14.82P
Oct	1989	130.8	153.2	—	—	—	—	—
P = Preliminary R = Revised since last month								
¹ Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.								
² Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.								
³ Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."								

GOVERNMENT STATISTICS
REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand) ¹	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100) ²	Consumer Price Index ³ (1985 = 100)	Production Price Index ⁴ All Groups ⁴ (1980 = 100)	Total Employment in Mining and Quarrying ⁵	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) ⁵
1980	Avg.	35.53	—	51.9	100.0	709,042	2,237,689
1981	Avg.	41.89	—	59.8	113.6	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	129.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	143.1	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	155.1	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	181.2	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	216.6	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	246.8	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	279.3	705,355	7,774,054
Jan	1989	—	—	166.8	299.8	714,593	704,320
Feb	1989	—	—	168.2	305.4	696,329	669,983
Mar	1989	112.29	262.8	170.9	310.0	702,746	695,843
Apr	1989	—	—	173.1	315.0	658,677	634,344
May	1989	—	—	175.9	319.6	706,056	721,263
June	1989	113.76	267.0	177.7	320.9	706,810	720,586
July	1989	—	—	179.3	324.0	711,648	775,002
Aug	1989	—	—	181.8	327.5R	703,812	793,475
Sept	1989	119.76	280.2	183.4	329.3	—	—
Oct	1989	—	—	185.1	—	—	—

P = Preliminary R = Revised since last month

¹Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

²Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

³Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 236.

⁴Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

⁵Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

GOVERNMENT STATISTICS

UNITED STATES									
Producer Price Index ¹					Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴				
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	Consumer Price Index ² (1982-1984 = 100)	GNP Implicit Price Deflator ³ (1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
Jan	1989	109.4	110.5	121.1	—	13.80	13.49	12.85	10.27
Feb	1989	110.1	110.8	121.6	—	13.66	13.48	12.88	10.26
Mar	1989	110.5	111.5	122.3	125.4	13.71	13.51	12.91	10.30
Apr	1989	111.8	112.3	123.1	—	13.68	13.65	12.92	10.31
May	1989	112.1	113.2	123.8	—	13.60	13.57	12.98	10.33
June	1989	112.4R	112.9R	124.1	126.0	13.62	13.66	12.98	10.37
July	1989	112.2	112.7	124.4	—	13.70	13.75	13.12	10.41
Aug	1989	111.4	112.0	124.6	—	13.64R	13.72	13.08R	10.40R
Sept	1989	111.9	112.3	125.0	126.8	13.72P	13.85P	13.18R	10.48R
Oct	1989	112.4	112.7	125.6	—	—	—	13.21P	10.47P

P = Preliminary R = Revised since last month

¹US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

²US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

³US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

⁴US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

Nuclear Industry Calendar

1990

- | | |
|--------------------|--|
| Jan. 22-26 | <i>Nuclear Fuel Cycle Committee</i> (Las Vegas, Nevada), sponsored by the American Society for Testing and Materials. Contact Ms. Katharine Schaaf at the ASTM at 1-215-299-5529. |
| Mar. 4-8 | <i>7th Pacific Basin Conference</i> (Sheraton Harbor Island Hotel, San Diego, California), sponsored by the ANS. Contact the ANS Meetings Department at 1-312-352-6611. |
| Mar. 25-28 | <i>Fuel Cycle '90 Conference</i> (Opryland Hotel, Nashville, Tennessee), sponsored by the US Council for Energy Awareness. Contact the USCEA Conference Office at 1-202-293-0770. |
| Apr. 8-12 | <i>First Annual International High-Level Radioactive Waste Management Conference</i> (Caesar's Palace Hotel, Las Vegas, Nevada), sponsored by the American Nuclear Society and American Society of Civil Engineers. Contact the ANS at Meetings Department at 1-312-352-6611. |
| Apr. 9-11 | <i>23rd JAIF Annual Conference</i> (Kyoto, Japan). Contact Ms. Sachie Sugoh, Dept. of Planning and International Affairs, JAIF, at 03-508-9056. |
| Apr. 22-25 | <i>INFO '90</i> (Westin Hotel, Dallas, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770. |
| Sept. 5-7 | <i>Uranium Institute 15th Annual Symposium</i> (London, United Kingdom). Contact the UI at 44-1-225-0308. |
| Sept. 16-19 | <i>Uranium Seminar '90</i> (Hyatt Regency, San Antonio, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770. |
| Nov. 11-14 | <i>Nuclear Energy Forum</i> (Washington Hilton, Washington, D.C.), sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611. |

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NUEXCO MONTHLY REPORT
December 1989, No. 256

EXECUTIVE SUMMARY
(All data as of November 30, 1989)

Exchange Value
\$9.20, down \$0.20

The Exchange Value is \$9.20 per pound U_3O_8 , down \$0.20 from last month.

UF₆ Value
\$27.75, down \$0.50

The UF₆ Value is \$27.75 per kg U as UF₆, down \$0.50 from last month.

Uranium Sales;
Supply and
Demand

Six recent **natural uranium** sales and two **enriched uranium product** sales are reported, involving approximately **2.2 million** pounds equivalent U_3O_8 . Six of these sales involved spot or near-term delivery and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **8.3 million** pounds U_3O_8 equivalent, up approximately 0.4 million pounds since last month. Active spot and near-term **uranium demand** totals **2.6 million** pounds, down about 2.3 million pounds from last month. The spot and near-term **supply-demand ratio**, at **3.1 to 1**, increased greatly from last month's ratio of 1.3 to 1.

Transaction Value
\$9.55, down \$0.10

The Transaction Value is \$9.55 per pound U_3O_8 , down \$0.10 from last month. The calculation includes 17 transactions involving a total of approximately 3.5 million pounds U_3O_8 equivalent and covers a period of three months.

Loan Rate
3.5%, unchanged

The Loan Rate is 3.5 percent per annum, unchanged. One natural uranium loan is reported.

Conversion Value
\$1.75, down \$0.05

The Conversion Value is \$1.75 per pound U as UF₆, down \$0.05 since last month. Two transactions for conversion services are reported.

SWU Value
\$57, down \$2

The SWU Value dropped \$2 to \$57 per SWU. Three enrichment transactions are reported, two of which involved EUP. Active supply and demand both decreased from last month.

* * *

1989 Preliminary
Market Review

Although another month remains in 1989, the volume of uranium sold during the year already exceeds 20 million pounds U_3O_8 equivalent—the highest activity level since NUEXCO began reporting annual spot market volume in 1981. As numerous sellers liquidated inventories, and new and conventional suppliers aggressively sought available sales opportunities, the Exchange Value fell 22 percent.

Volatility of
Mineral Prices

As prices peaked at more than \$43 in 1977, then fell precipitously to less than \$10 today, the term "volatile" has often been used to describe the recent uranium market. However, when compared over the past forty years with the fluctuations in other natural resource prices, uranium price movements are not particularly volatile.

Restructuring of the
Uranium Production
Industry

Persistently low spot market prices, coupled with continued expectations that market conditions will remain depressed in the foreseeable future, have caused uranium producers to focus on "survivability" rather than "viability". This article examines how producers are responding to the current market situation.

NUEXCO REPORT 256 FIGURES OF THE MONTH (November 30, 1989)	This Month (Report 256)	Last Month (Report 255)	12 Months Ago (Report 244)
Exchange Value (\$US per pound U ₃ O ₈)	9.20	9.40	12.50
US Premium for the Exchange Value (\$US per pound U ₃ O ₈)	—	—	none
UF₆ Value (\$US per kg U as UF ₆)	27.75	28.25	37.50
US Premium for the UF ₆ Value (\$US per kg U as UF ₆)	—	—	none
Transaction Value (\$US per pound U ₃ O ₈ equivalent)	9.55	9.65	13.30
Loan Rate (Per Annum)	3.5%	3.5%	3.5%
Conversion Value (\$US per pound U as UF ₆)	1.75	1.80	1.95
Near-Term Uranium Supply ¹ (millions of pounds U ₃ O ₈)	8.3	7.9	6.6
Near-Term Uranium Demand ² (millions of pounds U ₃ O ₈)	2.6	5.9	0.4
Near-Term Supply-Demand Ratio	3.1	1.3	16.5
Recent Uranium Sales: ³			
Number of Transactions	8	6	8
Quantity of Material (Millions of pounds U ₃ O ₈ equivalent)	2.2	1.1	3.7
Nuexco SWU Value: (\$US per SWU) ⁴			
at 0.3 tails assay	57	59	65
US DOE SWU Prices: (\$US per SWU)			
USEC	118.00 ⁴	118.00 ⁴	117.00 ⁹
AFC	153.00 ⁶	153.00 ⁶	153.00 ⁶
Requirements	157.00 ⁶	157.00 ⁶	157.00 ⁶
Incentive Price	90.00 ⁷	90.00 ⁷	90.00 ⁷
Market Value of Enriched UF₆ ⁸ : (\$US per kg U as UF ₆)			
2.5 w/o U ₂₃₅	294	303	363
3.0 w/o U ₂₃₅	379	389	465
3.5 w/o U ₂₃₅	465	478	570
4.0 w/o U ₂₃₅	552	568	676

¹Active inquiries to sell, for delivery within 12 months after contract signing.

²Active inquiries to purchase, for delivery within 12 months after contract signing.

³Uranium sales only; does not include loans, conversion, or SWU transactions.

⁴Provisional price for DOE fiscal year 1990.

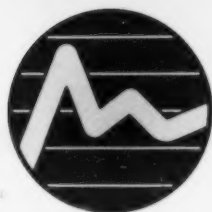
⁵Effective since 10/1/86.

⁶Effective since 10/1/84.

⁷Effective since 10/1/86, for up to 30% of annual requirements.

⁸Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

⁹Effective since 10/1/87 to 9/31/89.



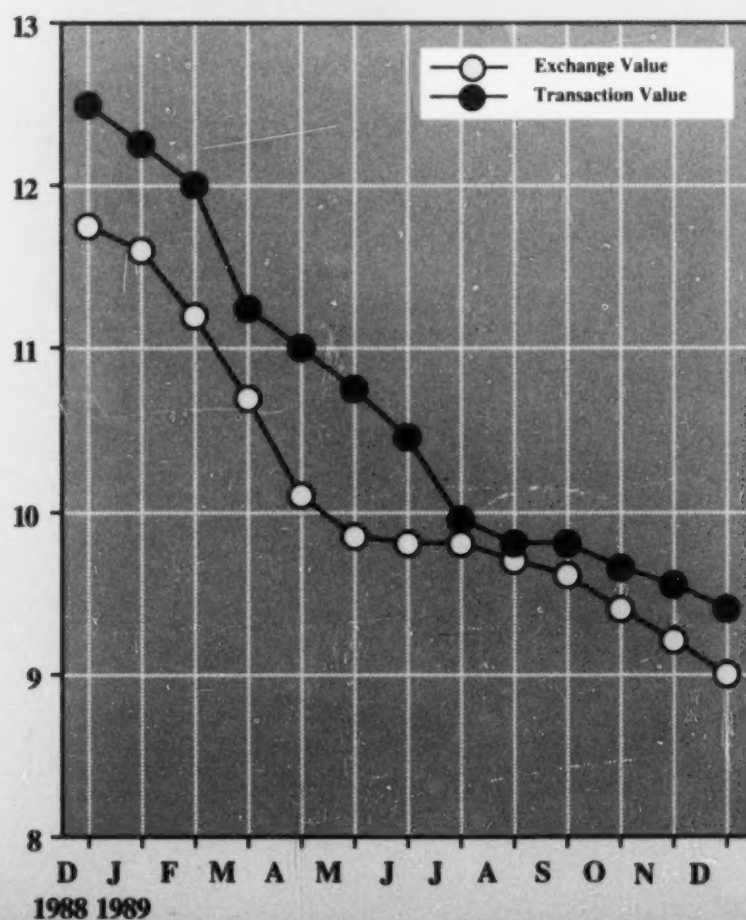
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NUEXCO

Monthly Report

January 1990
No. 257

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Annual Review, Uranium
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(IDNU), International Directory
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To Our Readers

* * *

We are pleased to announce the addition of **Ronald B. Witzel** and **Penny P. Quinn** to the NUEXCO organization.

Ron Witzel joined Pacific Gas and Electric Company in 1967, and became involved in nuclear fuel procurement activities three years later. Most recently Ron was Director of Nuclear Fuel Management, and his group was responsible for all contract negotiations, inventory management, fuel scheduling, and fuel finance and accounting activities. Ron obtained a Bachelor of Science degree in Business and Industrial Management from San Jose State University, and a Master of Business Administration from Golden Gate University.

Ron will be based in California and will work with NUEXCO International Corporation.



For the past seven years, **Penny Quinn** has been responsible for the supply of uranium concentrates and conversion services for Florida Power & Light Company's (FPL) four nuclear reactors. Between 1979 and 1983, Penny worked in FPL's nuclear fuel economics group developing long-term fuel forecasts and fuel cycle economic evaluations. Penny received a Bachelor of Business Administration degree in Finance and Accounting from Florida International University.

Penny will work with NUEXCO Information Services in Denver, Colorado.

* * *

Beginning next month, the Historical Market Data section of the Monthly Report will include a historical NUEXCO Loan Rate table. In this report, the table accompanies an article on uranium loans and the evolution of NUEXCO's Loan Rate.

PRICING
MARKET VALUES SUMMARY

December 31, 1989	Market Values	Active Supply ¹ (thousands)	Active Demand ¹ (thousands)
EXCHANGE VALUE ¹	\$9.00/lb U ₃ O ₈	4,835**	1,750**
UF ₆ VALUE ²	\$26.50/kg U as UF ₆		
LOAN RATE ³	3.5%/annum	8,235	0
CONVERSION VALUE ⁴	\$1.65/lb U as UF ₆	1,440	225
SWU VALUE ⁵ 0.3 tails assay:	\$54/SWU	730	400
TRANSACTION VALUE ⁶	\$/lb. U ₃ O ₈	Millions of Pounds	Number of Transactions
	9.40	4.2	21
			Number of Months
			3

*Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

**For both uranium concentrates and uranium hexafluoride.

DEFINITIONS

¹ The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

² The **UF₆ Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

³ The **Loan Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

⁴ The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

⁵ The **SWU Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

⁶ The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
b. At least ten transactions;
c. Transactions involving a sum total of at least 2 million pounds U₃O₈ equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

*All Market Values are based on:

- Data from recently completed transactions.
- Data from pending transactions.
- Firm bids to buy or borrow, and firm offers to sell or lend.
- Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell or lend.
- Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.
- In the determination of prices, Nuexco does not consider transportation charges other than those customarily provided by suppliers.
- The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
- For the SWU Value, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
- In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

PRICING

**NATURAL URANIUM AND
SPOT CONVERSION**

(All data as of December 31, 1989)

During the final month of 1989, spot market volume for uranium sales exceeded two million pounds U_3O_8 equivalent in ten transactions. This brings the total volume of uranium sold on the spot market in 1989 to approximately 22 million pounds U_3O_8 , and the total number of transactions to 100. Loans involving approximately nine million pounds U_3O_8 equivalent were made in 1989.

In other markets, 14 conversion transactions involving nearly 6.2 million pounds U as UF_6 were reported during the year, while eight enrichment sales involving more than one million SWU were reported.

The **Exchange Value** fell \$0.20 to **\$9.00** as market participants hastened to conclude deals before year-end. Approximately one million pounds of natural uranium concentrates were sold in five near-term transactions at prices ranging from 100 to 107 percent of the current Exchange Value. Most of the purchasers were US entities, consisting of three producers, one utility, and one intermediary. Sellers included two intermediaries and three producers—all from the USA. Although much of the material sold was for delivery in December 1989, more than half was specified for 1990 delivery.

* * *

The **UF_6 Value** declined from \$27.75 to **\$26.50**, primarily as a result of the excess of UF_6 supply on the market and the widespread perception of an increasing glut. Four UF_6

sales are reported, two of which were made by highly-motivated, aggressive sellers at prices well below the current UF_6 Value.

Several US utilities are actively selling UF_6 inventories. However, a trader selling a European government's uranium stockpile continues to offer prices well below other competitive sellers. Sales are being made at current market prices, in anticipation of being covered later by purchases from the government at market-related prices that are expected to be lower. Because this transaction is designed to generate a fixed amount of revenue for the government seller, it tends to increase available supply at decreasing prices.

* * *

The **Transaction Value** dropped \$0.15 to **\$9.40**. The calculation includes 21 transactions involving 4.2 million pounds U_3O_8 equivalent occurring over a three-month period.

* * *

Primarily because of year-end sales and a revised estimate of material available for sale at current prices, **Active Supply** of natural uranium fell sharply from 8.3 million pounds U_3O_8 equivalent to **4.8 million pounds**. **Active Demand** decreased by about 900 thousand pounds to **1.8 million pounds**. The new **Supply/Demand Ratio** is **2.8 to 1**, compared to 3.1 to 1 on November 30. (Please note that these figures have been revised since the December 31 Notice to Subscribers to reflect additional information.)

* * *

The **Loan Rate** remained steady at **3.5 percent** per annum. Three loans are reported totalling over 500 thousand pounds U_3O_8 equivalent. One loan occurred at or

near the Loan Rate, while two others involved other considerations which were reflected in rates above the current Loan Rate.

* * *

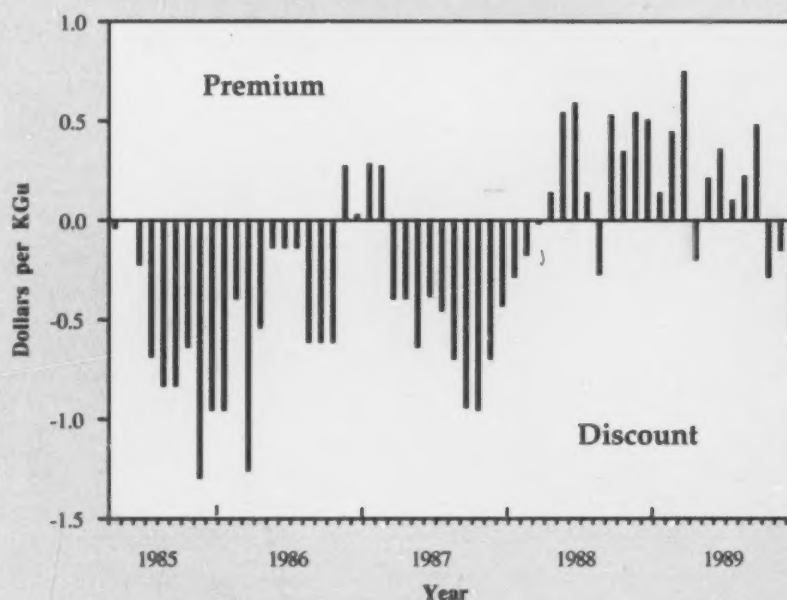
The Conversion Value fell from \$1.75 to \$1.65 in face of increasing competition between primary suppliers and UF₆ inventory holders. No conversion sales are reported. Due to the amount of excess UF₆, and the lack of demand for conversion services, the Conversion Value remains under pressure.

This month the UF₆ Value is \$0.65 less than the sum of its component values (the Exchange Value and the Conversion Value). **Figure 1**

shows that variations between the UF₆ Value and the sum of its components are the rule, rather than the exception. In fact, only once (May 1985) has the UF₆ Value been exactly equal to the sum of its components.

Because it is often more convenient to purchase UF₆ than to contract separately for U₃O₈ and conversion services, UF₆ often sells for a premium. This has been the case for much of the past two years. Since October 1989, however, UF₆ has been selling at a discount relative to the component prices. This may be attributed to the large amounts of UF₆ available on the market and the lack of substantial demand for UF₆.

Figure 1
NUEXCO UF₆ VALUE LESS
SUM OF UF₆ COMPONENT VALUES¹



¹ [(EV x 2.61284) + (CV x 2.20462)] - UF₆ Value

ENRICHMENT

The SWU Value declined from \$57 to \$54 per SWU. One sale of a small quantity of SWU contained in enriched uranium product is reported. One US utility is evaluating SWU offers, which are reported to be at or near the current SWU Value. Another US utility is seeking offers for EUP.

SWU supply remains plentiful, and the quantity of SWU available from the previously-mentioned European government stockpile increases as SWU market prices decline. Any further weakening of the US dollar will also result in increased supply as the European government sells its inventory (priced in US dollars) to generate a fixed level of revenue (in local currency). ■

CURRENT MARKET DATA

**EXCHANGE VALUE EXPRESSED IN SELECTED
PRODUCER & CONSUMER CURRENCIES¹**

Country (currency)	per lb U ₃ O ₈ as Concentrates			per kg U as Concentrates		
	This Month (Dec 31, 1989)	Last Month (Nov 30, 1989)	12 Months Ago (Dec 31, 1988)	This Month (Dec 31, 1989)	Last Month (Nov 30, 1989)	12 Months Ago (Dec 31, 1988)
Australia (dollar)	11.33	11.79	13.76	29.44	30.66	35.77
Belgium (comm. franc)	319.60	345.48	437.00	830.89	898.16	1,136
Canada (dollar)	10.41	10.73	14.02	27.07	27.89	36.44
EEC (ecu)	7.48	8.05	10.02	19.43	20.93	26.05
Finland (markka)	36.30	38.62	48.82	94.38	100.41	126.91
France (franc)	52.08	56.10	71.19	135.40	145.84	185.09
FRG (mark)	15.23	16.45	20.84	39.60	42.76	54.18
Italy (lira)	11,390	12,131	15,351	29,610	31,537	39,910
Japan (yen)	1,296	1,314	1,469	3,370	3,417	3,818
Netherlands (guilder)	17.17	18.55	23.59	44.64	48.22	61.33
South Africa (rand)	22.83	23.93	27.80	59.34	62.22	72.28
Spain (peseta)	985.11	1,060	1,331	2,561	2,755	3,461
Sweden (krona)	55.83	58.67	71.91	145.15	152.53	186.95
Switzerland (franc)	13.90	14.65	17.64	36.13	38.08	45.87
UK (pound)	5.62	5.88	6.50	14.61	15.28	16.89
US (dollar)	9.00	9.20	11.75	23.40	23.92	30.55

**TRANSACTION VALUE EXPRESSED IN SELECTED
PRODUCER & CONSUMER CURRENCIES¹**

Country (currency)	per lb U ₃ O ₈ as Concentrates			per kg U as Concentrates		
	This Month (Dec 31, 1989)	Last Month (Nov 30, 1989)	12 Months Ago (Dec 31, 1988)	This Month (Dec 31, 1989)	Last Month (Nov 30, 1989)	12 Months Ago (Dec 31, 1988)
Australia (dollar)	11.83	12.24	14.64	30.75	31.83	38.05
Belgium (comm. franc)	333.81	358.62	464.89	867.82	932.33	1,209
Canada (dollar)	10.88	11.14	14.91	28.27	28.95	38.77
EEC (ecu)	7.81	8.36	10.66	20.30	21.72	27.71
Finland (markka)	37.92	40.09	51.93	98.58	104.23	135.01
France (franc)	54.40	58.23	75.74	141.42	151.39	196.90
FRG (mark)	15.91	17.07	22.17	41.36	44.38	57.64
Italy (lira)	11,896	12,592	16,331	30,926	32,737	42,458
Japan (yen)	1,354	1,364	1,562	3,519	3,547	4,062
Netherlands (guilder)	17.93	19.25	25.10	46.62	50.06	65.24
South Africa (rand)	23.84	24.84	29.58	61.98	64.59	76.90
Spain (peseta)	1,029	1,100	1,416	2,675	2,860	3,682
Sweden (krona)	58.31	60.90	76.50	151.60	158.33	198.88
Switzerland (franc)	14.52	15.20	18.77	37.74	39.53	48.79
UK (pound)	5.87	6.10	6.91	15.26	15.86	17.97
US (dollar)	9.40	9.55	12.50	24.44	24.83	32.50

¹Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.

CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹						
Country (currency)	per lb U as UF ₆			per kg U as UF ₆		
	This Month (Dec 31, 1989)	Last Month (Nov 30, 1989)	12 Months Ago (Dec 31, 1988)	This Month (Dec 31, 1989)	Last Month (Nov 30, 1989)	12 Months Ago (Dec 31, 1988)
Australia (dollar)	2.08	2.24	2.28	4.58	4.95	5.03
Belgium (comm. franc)	58.59	65.72	72.52	129.18	144.88	159.89
Canada (dollar)	1.91	2.04	2.33	4.21	4.50	5.13
EEC (ecu)	1.37	1.53	1.66	3.02	3.38	3.67
Finland (markka)	6.66	7.35	8.10	14.67	16.20	17.86
France (franc)	9.55	10.67	11.82	21.05	23.52	26.05
FRG (mark)	2.79	3.13	3.46	6.16	6.90	7.62
Italy (lira)	2,088	2,307	2,548	4,603	5,087	5,617
Japan (yen)	237.62	250.00	243.72	523.85	551.16	537.31
Netherlands (guilder)	3.15	3.53	3.91	6.94	7.78	8.63
South Africa (rand)	4.18	4.55	4.61	9.23	10.04	10.17
Spain (peseta)	180.60	201.57	220.94	398.16	444.38	487.08
Sweden (krona)	10.24	11.16	11.93	22.57	24.60	26.31
Switzerland (franc)	2.55	2.79	2.93	5.62	6.14	6.45
UK (pound)	1.03	1.12	1.08	2.27	2.46	2.38
US (dollar)	1.65	1.75	1.95	3.64	3.86	4.30

SWU VALUE AND UF ₆ VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹				
Country (currency)	SWU Value at 0.30% Tails Assay This Month (Dec 31, 1989)	SWU Value at 0.30% Tails Assay Last Month (Nov 30, 1989)	UF ₆ Value per kg U as UF ₆ This Month (Dec 31, 1989)	UF ₆ Value per kg U as UF ₆ Last Month (Nov 30, 1989)
Australia (dollar)	67.95	73.08	33.34	35.38
Belgium (comm. franc)	1,918	2,140	941.05	1,036
Canada (dollar)	62.48	66.46	30.66	32.18
EEC (ecu)	44.85	49.87	22.01	24.14
Finland (markka)	217.83	239.29	106.89	115.86
France (franc)	312.50	347.56	153.35	168.29
FRG (mark)	91.40	101.89	44.85	49.33
Italy (lira)	68,337	75,158	33,536	36,392
Japan (yen)	7,777	8,143	3,816	3,943
Netherlands (guilder)	103.01	114.92	50.55	55.64
South Africa (rand)	136.95	148.28	67.20	71.80
Spain (peseta)	5,911	6,565	2,901	3,179
Sweden (krona)	334.99	363.50	164.39	176.00
Switzerland (franc)	83.38	90.75	40.92	43.94
UK (pound)	33.73	36.41	16.55	17.63
US (dollar)	54.00	57.00	26.50	27.60

¹Calculated using currency exchange rates published in the *Wall Street Journal* on the last working day of the month.



CURRENT MARKET DATA

RECENT TRANSACTIONS¹

URANIUM SALES

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U ₃ O ₈ equivalent)	Approximate Price Range ² as Percent of Current Exchange or UF ₆ Value	Seller	Buyer	Remarks
4701	1990	101-300	103-107	Intermediary	Producer	
4702	1989	50-100	98-102	R ³	Utility	UF ₆
4703A	1990	301-600	See Remarks	Utility	Intermediary	Contained in Low-Enriched Uranium
4704	1990	101-300	98-102	Producer	Utility	
4705	1991	101-300	R ³	Intermediary	Utility	UF ₆
4710	1990	101-300	93-97	R ³	Intermediary	UF ₆
4711	1990	301-600	R ³	Utility	R ³	UF ₆
4712	1989	50-100	98-102	Producer	Intermediary	
4713	1990	50-100	103-107	Intermediary	Producer	
4715	1989	101-300	98-102	Producer	Producer	

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

CURRENT MARKET DATA
LOAN TRANSACTIONS¹

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U ₃ O ₈ equivalent)	Approximate Price Range ² as Percent of Current Loan Rate	Lender	Borrower	Remarks
4707	1989	101-300	R ³	Intermediary	Producer	
4708	1989	101-300	R ³	Intermediary	Producer	
4714	1989	101-300	98-102	Producer	Intermediary	

**CONVERSION SERVICES
SPOT MARKET SALES¹**

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U equivalent)	Approximate Price Range ² as Percent of Current C.V.	Seller	Buyer	Remarks
<i>No transactions for conversion services are reported</i>						

**ENRICHMENT SERVICES
SECONDARY MARKET SALES¹**

NUEXCO Transaction Number	Delivery Period	Approximate Quantity ⁴ (thousand SWUs)	Approximate Price Range ² as Percent of Current SWU Value ⁵	Seller	Buyer	Remarks
4703B	1990	50-100	See Remarks	Utility	Intermediary	Contained in Low-Enriched Uranium

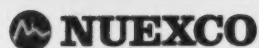
¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

⁴ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 w/o tails assay.

⁵ Prices are usually normalized to 0.30% tails assay. Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.



CURRENT MARKET DATA

URANIUM SUPPLY (December 31, 1989)			
Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Available for Sale ACTIVE			
89-1001	1,300	1,000 per year	1990, UF ₆
89-1180	1,000	—	1990
89-1188*	60	—	1990
89-1194	100	—	1990
89-1201*	1,500	—	1990
89-1252*	375	375 per year	1990-96
89-7000A*	500	—	1990, UF ₆
.....			
Total	4,835		
INACTIVE			
89-1029	1,200	300 per year	1990-98
89-1076	500	250 per year	1990 on
89-1128*	1,130	—	1990, U ₃ O ₈ /UF ₆
89-1156*	200	—	1990
89-1209*	400	400 per year	1990-93
.....			
87-1000*	—	600 per year	1991-95
87-1005	—	250 per year	1990-95
87-1109	—	350 per year	1990-on
87-1123	—	1,000 per year	1990-on
88-1157	—	1,000 per year	1990 on, UF ₆
Total	3,430		
[*] New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 88-1026, 88-1001, 89-1172, 89-1239, 89-1249.			

CURRENT MARKET DATA

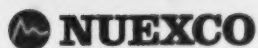
URANIUM DEMAND (December 31, 1989)			
Delivery Period¹ (Thousand Pounds of U₃O₈)			
NUEXCO Project Number	Spot or Near-term²	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
89-1183	400	—	1990
89-1218	1,000	1,000 per year	1990-93
90-1001*	350	—	1990
.....			
88-1227	—	1,600	1990-95, U ₃ O ₈ /UF ₆
89-1090	—	150 per year	1991-96
89-1172	—	500 per year	1992 on
89-1176	—	600 per year	1991-96
89-1192	—	1,200	1992-97
89-1233*	—	160	1991, UF ₆
89-1236*	—	250	1991-94, U ₃ O ₈ /UF ₆
89-1237*	—	130 per year	1991-94, UF ₆
89-1242*	—	75 per year	1992-94
89-1254*	—	270 per year	1991-2000
89-1256*	—	200 per year	1991-94
89-1260*	—	250 per year	1992-94
Total	1,750		
INACTIVE			
89-1067	500	—	1990
89-1163	1,000	—	1990
89-1167	350	350 per year	1990-94
89-1175*	170	170 per year	1990-91
89-1187	325	—	1990, UF ₆
.....			
Total	2,345		
[*] New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 89-1189, 89-1208, 89-1230, 89-1232, 89-1238, 89-1241, 89-1250, 89-1258.			

CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND			
(December 31, 1989)			
NUEXCO Project Number	Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)		Remarks
	Within 1 Year	Beyond 1 Year	
Available for Loan:			
ACTIVE			
87-1167	460	—	UF ₆
88-1182	4,000	—	U ₃ O ₈ /UF ₆
89-1077	500	—	U ₃ O ₈
89-1186	200	—	U ₃ O ₈
89-1196	1,300	—	UF ₆
89-1206	300	—	U ₃ O ₈
89-1225	700	—	U ₃ O ₈
89-1248*	750	—	U ₃ O ₈
Total	8,235		
INACTIVE			
None reported			
Available to Borrow:			
No inquiries to borrow are reported			
[*] New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 89-1184.			

CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND (December 31, 1989)			
Delivery Period¹ (Thousand Pounds of U as UF₆)			
NUEXCO Project Number	Within 3 Years	Beyond 3 Years	Remarks
Available for Sale ACTIVE			
89-7000C*	400	—	
89-7001A*	440	—	
89-7002*	600	—	
Total	1,440		
INACTIVE <i>None reported</i>			
Inquiries to Purchase ACTIVE			
89-1251*	225	—	
89-1245*	—	8,650	
Total	225		
INACTIVE <i>None reported</i>			
[*] New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: None.			



CURRENT MARKET DATA

SWU SUPPLY AND DEMAND (December 31, 1989)			
NUEXCO Project Number	Delivery Period ¹ (Thousand SWUs)		Remarks
	Spot or Near-term ²	Intermediate or Long-term	
Available for Sale			
ACTIVE			
88-1082	25	—	1990
88-1096	190	—	1990
88-1200*	90	—	1990
89-7000B*	300	—	1990
89-7001B*	125	—	1990
Total	730		
INACTIVE			
87-1128	360	—	1990
88-1210*	300	—	1990
Total	660		
Inquiries to Purchase			
ACTIVE			
88-1236	250	—	1990-94
89-1243	150	—	1990
88-1061	—	500	1991-95
89-1203	—	135	1991-92
89-1262*	—	120	1996-99
Total	400		
INACTIVE			
89-1043	50	—	1990
89-1047	—	600	1991-95
Total	50		
[*] New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts. Projects removed since last month: None.			

RECENT DEVELOPMENTS

On December 12, 1989, the New York Times published its first pro-nuclear editorial in years. This further substantiates the growing realization by the public that the nuclear energy option must be maintained. For your interest, the editorial is reprinted below in its entirety.

Revive the Atom

Nuclear power is not inherently unworkable. It already produces 17 percent of the world's electricity, and 20 percent in the United States. Yet "nuclear," to many Americans, has become a dirty word, almost synonymous with risk, waste, cost and unseen pollution. That image is misleading. The United States cannot afford to wash its hands of an energy option that could prove both competitive and environmentally benign. The nuclear industry is worth reviving.

Technology is the easier part—a new generation of safer, cheaper nuclear power plants is already on the drawing boards. The tough part is changing public attitudes. Many have been disillusioned by the cost overruns of plants like Seabrook, and frightened by calamities like Three Mile Island and Chernobyl. No new power plant has been ordered since 1978. A fully built, \$5.5 billion plant at Shoreham on Long Island, declared safe by Federal regulators, has even been prevented from operating by local fears and supine politicians.

But there are compelling reasons to rethink those attitudes. Foremost is the greenhouse effect, the threatened warming of the earth's climate by waste gases like carbon dioxide. The burning of coal, oil, gas and wood contributes to the buildup of this invisible waste. Nuclear-generated electricity does not. And unlike coal, neither does it create the acrid gases that form acid rain.

The present generation of nuclear plants has failed to thrive in the United States; no utility will build another. Yet countries like France, which lack America's energy abundance and freedom to dally, have taken the same American nuclear designs and built safe, efficient plants from which they generate substantial portions of their electricity.

These designs, however, are far from ideal. They are scaled-up versions of the plants designed to propel nuclear submarines. They need elaborate plumbing and safety devices to keep the nuclear core flooded with cooling water under all circumstances. The U.S. compounded these

problems with overlarge plants, each custom-made for individual utilities. Some utilities were far less capable than others in handling these complex behemoths. Little wonder that construction time stretched from 6 years to as long as 14 years, driving costs skyward, and once in operation the plants' generating time and safety margins often proved disappointing.

But that experience cannot reasonably be taken as the last word on nuclear energy. The new plants now being designed put safety first. In the worst possible accident, they will shut themselves down with little or no intervention. The new

plants would also be smaller, easier to mass-produce and simpler to regulate. The industry asserts they will be cheaper than coal-fired plants, and says some designs are so safe that off-site insurance will not be necessary. After all the false promises about nuclear energy, no one is going to take such claims on faith. But they surely deserve a fair test.

Even if the new nuclear plants can be made safe and efficient, two objections remain. One is that with conservation and new forms of solar energy, there will be no need for nuclear

energy. Maybe. But the slight possibility that a nuclear option won't be needed is a poor reason for not preparing one.

A second objection is that the issue of nuclear waste is unresolved. But the technical solution—turning the waste into glass bricks that are stored in a geologically stable underground vault—is achievable; what's delaying it is political wrangling over where the waste site should be.

Safe, cost-effective nuclear power plants would be environmentally benign, and offer major insurance against climate warming. Instead of [opposing] nuclear energy under any terms, environmentalists should be pressing to create the conditions of public acceptability under which the new generation of designs can be born. Energy planners will then be able to choose among nuclear, solar and conservation. Having options almost always beats having none.

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Nuclear Power: Hardly a Pariah How some countries produce their electricity

Country	Nuclear	Coal	Other
France	70%	9%	21%
South Korea	47	25	28
West Germany	34	49	17
Japan	28	61	11
United States	20	56	24
Soviet Union	11	37	52
India	3	72	25

Source: U.S. Council for Energy Awareness

RECENT DEVELOPMENTS

WASHINGTON FOCUS

In recess since November 22, Congress will not reconvene until January 23. Its first priority upon returning to work is the FY 91 budget. Preliminary reports have indicated the Special Isotopic Separator (SIS) program the Defense Department funds at Lawrence Livermore National Laboratory may receive a reduction in funding. If Congress enacts the cut, it may affect the AVLIS research program, which is also conducted at the Lab.

Radionuclide Emissions Regulations

The EPA radionuclide emission rule was finally published in the Federal Register on December 15 (See **Table 1** below). There will be a 90-day interim period for all affected facilities to come into compliance. All mines, even those on stand-by, are subject to this requirement. Mills and other Nuclear Regulatory Commission (NRC)-regulated facilities, however, received a 60-day stay from the Environmental Protection Agency (EPA), pending a review of the implications of dual regulation (the NRC and the EPA).

A company may petition for reconsideration during the first 60-days, provided it raises a new issue or requests clarification of part of the new rule. (NUMARC has already filed a petition for reconsideration.) Since the new rule differs from the proposed rule, only those issues raised during the initial comment period or within this 60-day interim period, will be considered litigable issues before a court. Although the impact of the regulation is still uncertain, the EPA has tested data from Pathfinder Mines Corporation's underground facilities with the new Comply R compliance code, and it appears the facilities could comply with that part of the new rule. ■

Table 1
SUMMARY OF CURRENT AND FINAL RULES

Source Category	Number of Facilities	Current Rules	New Rules
DOE facilities	45	25 mrem/yr	10 mrem/yr EDE ¹
NRC licensees	6,000	25 mrem/yr	10 mrem/yr EDE
Nuclear reactors and support facilities	135	25 mrem/yr	10 mrem/yr EDE
Underground uranium mines	15	Bulkheads	10 mrem/yr EDE
Uranium tailings (disposal)	46	20 pCi/m ² -s radon	20 pCi/m ² -s radon
Uranium tailings (operations)	4	Close within 6 years and apply new technology	20 pCi/m ² -s radon
Uranium tailings (new construction)	0	Phased/continuous disposal	Phased/continuous disposal
DOE radon sources	5	No rule	20 pCi/m ² -s
Phosphogypsum stacks	40	No rule	20 pCi/m ² -s
Elemental phosphorus plants	5	21 Ci/yr Po-210	2 Ci/yr Po-210
High-level nuclear waste facilities	0	No rule	No rule
Coal-fired boilers	1,500	No rule	No rule
Surface uranium mines	2	No rule	No rule

Source: *ANS Nuclear News*, December 1989

¹Effective dose equivalent

Nuclear Fuel Industry Developments	
December	
1	The Western Governors Association unanimously passed a resolution urging western representatives in the US House to support S. 83, the uranium enrichment bill.
8	Due to unresolved safety issues, Canada's Atomic Energy Control Board denied Ontario Hydro's Darlington plant an operating license for the second time.
15	Japan's Nuclear Energy Commission of the Advisory Committee for Energy convened to discuss modifications to the nuclear plant construction plan through the year 2010. This was the Committee's first meeting in three years, which arose due to difficulties in site selection.
15	The \$4.5 million cleanup of Union Carbide's uranium mill tailings site in Green River, Utah was completed. This was the fifth site completed under the Uranium Mill Tailings Radiation Control Act of 1978, funded 90 percent by the federal government and 10 percent by the state.
15	Cameco has scheduled a four-month shutdown in mid-1990 at its Blind River refinery and Port Hope conversion plant due to deteriorating market conditions.
15	Argentina's Los Gigantes U ₃ O ₈ mill (150-MT/year capacity) shut down due to miscalculations in proven recoverable reserves. Two other uranium mills remain in operation in Argentina.
18	The European Community (EC) and the Soviet Union signed an agreement to conduct joint research and development in nuclear power, concentrating on safety. The program will be administered under the Euratom Treaty.
19	Ontario Hydro announced it would seek approval from a provincial environmental board to expand its nuclear capacity and build ten additional 881-MWe Candu plants to meet baseload demand through 2013.
20	Siemens KWU, Inc. and its affiliate Advanced Nuclear Fuels Corporation (ANF) announced the consolidation of Siemens' US nuclear plant activities and those of Advanced Nuclear Fuels Corporation (ANF) under a new services organization within ANF. ANF will also serve as the Siemens KWU partner in the Bechtel-KWU alliance.
23	Due to increasing electricity demand, the President of Newfoundland Light & Power Co. is interested in considering nuclear power as a future energy option for the Canadian island.

BASIC CONSIDERATIONS

URANIUM LOANS

Introduction

When NUEXCO was organized in 1968, its founders conceived of a business based on uranium loans. The concept was relatively straightforward; those who found themselves with excess supplies of uranium would deposit those excesses in NUEXCO's "bank", and those who found themselves temporarily short of uranium could borrow from the bank. The borrower would pay interest based on the quantity of uranium borrowed and the duration of the loan, and the bank would collect the interest, deduct its service fee for arranging the loan, and pay the balance to those whose deposits were borrowed. In fact, the original plan was to call the firm Nuclear Bank Corporation, until it was discovered that using the word "Bank" in the name would subject the firm to various US banking regulations. Thus, *Nuclear Bank Corporation* became *Nuclear Exchange Corporation*, which was later shortened to *NUEXCO*.

Neither the nuclear fuel market nor NUEXCO's business developed quite as its founders had anticipated. From almost the very beginning, the brokerage of uranium purchases and sales became a more significant activity for NUEXCO than arranging uranium loans. Nevertheless, loan transactions have played an important role in the international nuclear fuel market, requiring the development of special knowledge and commercial techniques.

NUEXCO's Early Role

NUEXCO's role in uranium loans began in September 1968 with the publication of NUEXCO Monthly Report No. 1, and the recognition of three factors that are fundamental to any loan transaction. First was a Loan Rate, i.e., an interest rate payable to uranium lenders. In Report No. 1 that rate was described as the "Use charge payable to Depositors" and was established at four percent per annum.

Second, there was a need for a uranium value to which the interest rate could be applied in order to determine the amount of interest payable. NUEXCO Report No. 1 termed that value the Loan Value and provided that it would be calculated on a case by case basis to "recognize the peculiarities of each particular loan situation, and the need to be competitive with the Atomic Energy Commission (AEC) leasing program."

Finally, there was a need to establish a means for financial settlement of loans, because book transfers had not yet become the usual mode of delivery, and it was unlikely that the borrower would be able to repay the exact number of pounds borrowed. Thus, the first NUEXCO Report published a value, then called the Settlement Value, that was intended to be used in computing financial settlements for loan transactions when the quantity of uranium repaid was slightly more or less than the quantity borrowed. In that first Report, the Settlement Values ranged from \$6.50 to \$8.50 per pound U₃O₈, depending on when the loan was to be repaid.

As the market developed, the Loan Value, designed to be used (with the Loan Rate) to calculate the amount of interest payable on a loan, and the Settlement Value, designed to be used in settling uranium loans, merged and evolved into the Exchange Value, which has come to fulfill an entirely different and unexpected market role. Historical Loan Rates appear in **Table 1** on page 17.

Loan Participants

Holding most of the uranium inventory, electric utility companies have been the principal, though by no means the only, lenders. Producers, fuel fabricators, traders, and even national governments have all assumed the lender role at one time or another. Equally diverse are the reasons for lending, with the most common being the opportunity to earn a return on otherwise idle inventory. Other reasons may include one or more of the following:

- acquiring additional uranium by accepting interest in kind (uranium) in terms of pounds rather than dollars;
- enhancing or expanding existing commercial relationships;
- establishing new commercial relationships;
- assisting sister utilities, fellow producers, or others with emergency short-term needs;
- changing the form, location, or origin of particular lots of uranium, by returning material differing in one or more aspects (physical, political, or financial) from the material borrowed.

At first, NUEXCO expected utilities to become the principal uranium borrowers. And utilities did participate in some transactions as borrowers, for various reasons:

BASIC CONSIDERATIONS

Table 1
NUEXCO HISTORICAL LOAN RATES

Determined as of the last day of the month indicated (Percent per Annum)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50

* Float with Prime Rate

■ need resulting from sudden or unexpected events such as fuel failures, interruptions of supply resulting from *force majeure*, or contract litigation;

■ need associated with the purchase of additional fabricated fuel, usually to achieve some end, such as security of supply;

■ need associated with a recognized mismatch or window between date of need and scheduled supply;

■ need to fulfill an existing conversion or enrichment obligation.

But for ten years or more, utilities have not been the principal uranium borrowers. Given current utility

inventory policies and levels, even the most sudden or unexpected events are unlikely to force utilities into the loan market as borrowers; after all, it is to mitigate just such disruptions that inventories are acquired and maintained in the first place.

In fact, producers and traders have been the most frequent uranium borrowers. Producers have borrowed when unforeseen events (strikes, natural disasters, or equipment failures) threatened their ability to meet scheduled delivery commitments. While it might be possible to invoke *force majeure* in such circumstances, there may be commercial incentives (such as high delivery prices or the desire to retain the reputation for reliable delivery) that argue for going to the time and expense of arranging a loan in order

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to ensure timely delivery. Producers might also borrow for other reasons.

- A new producer might use borrowed material to effect market entry prior to onset of production.
- An active producer might use borrowed material to satisfy conscious over-commitments undertaken to exploit favorable market conditions.
- A producer might use borrowed material to fill existing contracts, thereby avoiding current expenditures for production and raising cash.
- A producer might borrow material of an origin other than its own production to preserve its own origin material for other contracts or perceived premium values.
- A producer might use borrowed material in lieu of produced material to minimize its taxable income or to otherwise manage its income tax position.

But the most common reason for borrowing is to take advantage of perceived market opportunities. Thus, seeing an opportunity to make a spot uranium sale at an attractive price while lacking immediately available supply, a producer or trader might commit to the sale, borrowing the uranium needed to make the delivery.

Loans, which are essentially contracts for future delivery, offer several advantages to the producer/borrower over conventional bank financing:

- Uranium loans are typically made at interest rates substantially below commercial bank rates.
- Compensating balances are avoided.
- Existing lines of credit will not necessarily be affected.

As in conventional financing, cash received from the sale of borrowed material is usually non-taxable upon receipt. Depending on a producer's assumptions about (a) future market conditions, (b) the value of current cash and (c) the prices at which he might be able to contract for forward supply, borrowing material to sell in the spot market might result in greater economic benefit than a conventional forward sale.

Some utility lenders have regarded producer/borrowers as particularly good credit risks, as a result of their ownership of uranium resources and control of milling capacity. Such reasoning ignores, or at least downplays, the risks inherent in factors such as regulatory or environmental concerns,

grade and quantity of reserves, mining efficiency, and processing costs. Traders, with their diversification of contracts to purchase from multiple sources and a strong financial position, can present a lower overall risk profile than even a large producer/borrower.

Several other factors may also inhibit an inventory holder's willingness to lend uranium.

- Problems associated with the possibility of a uranium loan being viewed as lending credit may present a difficult situation for some government-owned utilities.
- Uranium inventories may be subject to the lien of the utility's mortgage bond indenture and, therefore, not readily available for loan without formal release by the indenture trustee.
- Some potential lenders may be concerned that a loan might cause unfavorable tax consequences if misinterpreted by tax authorities as a purchase and sale.
- Loan revenue may be used to reduce revenue which the utility would otherwise receive from fuel adjustment clauses.
- Loan revenue may be used to reduce the income which the utility would otherwise earn under allowance for funds used during construction.
- Purely commercial considerations may also have an effect. Location of the uranium (producer's mill, converter, USDOE, or storage facility), form (concentrates, natural UF₆, or enriched UF₆) and national origin may all be limiting factors.

Current Role of NUEXCO and Other Traders

NUEXCO, as previously noted, in its early years provided services to participants in the uranium marketplace through brokerage or exchange activities. In recent years, a much stronger and redirected NUEXCO, as well as other traders (including producers and utilities), have increased the volume of nuclear fuel transactions partly through the use of uranium loans. Trading and commodity lending activities are common in many commodity markets and generally increase their efficiency. Such activities provide additional capital cushions and liquidity for temporary inventory excesses, as well as additional sources of spot supply. Traders such as NUEXCO, through their active

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marketing organizations, utilize borrowed inventory to facilitate sales transactions while generally hedging any market risks with offsetting spot and long-term purchase contracts. The increased trading volume and market competition undoubtedly are factors in permitting utility/purchasers during a general oversupply period to more efficiently achieve the lowest purchase price available. Similarly, during a general undersupply period, such activities will permit producer/sellers to achieve the highest price available. Thus, uranium lending will probably not only remain an active factor in the market, but could increase significantly in the future and involve additional forms of uranium.

Loan Rates

The very concept of a loan—be it of money, a commodity, services, or something else—presumes that some type of consideration will be paid by the using party (the borrower) to the providing party (the lender). Calculating the amount of that consideration typically requires establishing an interest factor to apply to the value of the loan material. NUEXCO refers to that interest factor as the Loan Rate. In the interest of historical accuracy it should be noted that the Loan Rate was originally known as the Use Charge (from September 1968 through October 1979) and then as the Loan Use Charge Rate (from November 1979 through December 1985, when the term Loan Rate came into use).

The Loan Rate is an annual, simple interest rate which, in Nuexco Report No. 1 of September 1968, was defined as the "Use charge payable to Depositors." In the parlance of that period a "Depositor" was a lender. Since NUEXCO was to be paid a fee for its services in arranging loans, the borrower's cost was the "Use Charge" plus NUEXCO's fee.

A year later in September 1969, the Loan Rate (still then referred to as the Use Charge) was redefined in terms of what the borrower paid (rather than what the lender received), specifically as that "payable by the borrowers; depositors are paid approximately 1% less." While this definition remained essentially unchanged through October 1979, it was amplified in November 1973 with the following language as:

"The Exchange's [NUEXCO's] judgment of the interest rate at which near-term yellowcake loans could be obtained. It is based on transaction data, the money market prime rate, and the relation

between uranium near-term supply and demand. The Use Charge is paid by the borrower; the depositor receives approximately one percent less."

Other than minor, non-substantive modifications, the Loan Rate definition remained unchanged until redefined in November 1979 as:

"NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated."

That definition was described as being based on:

- a) Data from recently completed transactions,
- b) Data from pending transactions,
- c) Firm bids to borrow and firm offers to lend, and
- d) Rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to borrow, and rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to lend.
- e) Rates associated with old or renegotiated contracts or other than arm's-length transactions are not considered in determining the Loan Rate."

The level of the Loan Rate has varied from a high of eight percent (from late 1973 to early 1975) to a low of three percent (during the first half of 1987), and, with one exception, has always been less than (and, since 1979, substantially less than) the prime rate. That exception was a 12-month period during 1976 and 1977 when the Loan Rate was simply made equivalent to the prime rate. The historical relationship between NUEXCO's Loan Rate and the prime rate is shown in **Figure 1**.

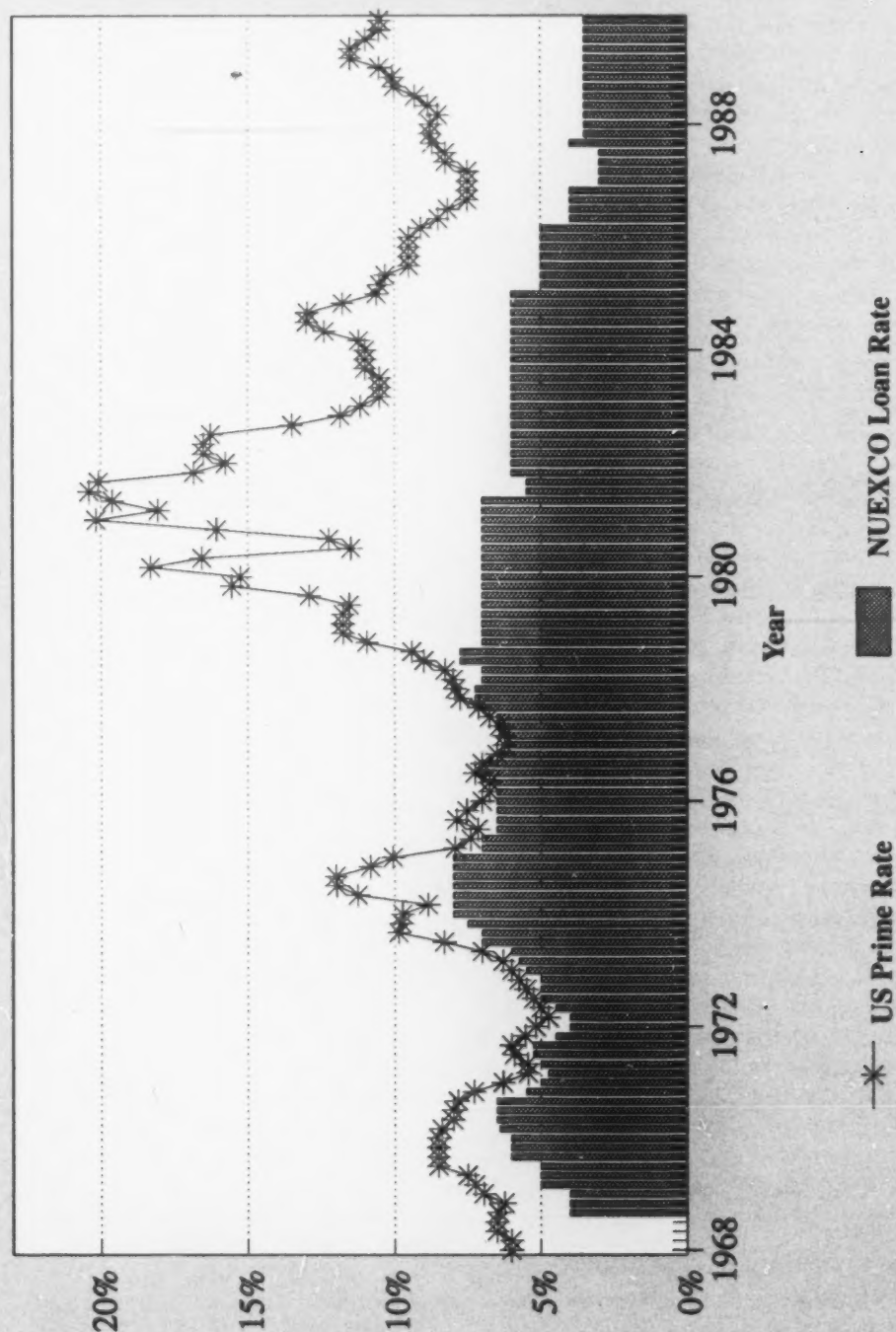
The absolute Loan Rates established over the years reflect the interaction of three principal factors:

- the general level of interest rates,
- the current level of uranium prices, and
- the current supply/demand/inventory balance.

Reference to **Figure 1** will demonstrate that, other things being equal, any of these factors can affect the Loan Rate. Thus, during the 1970s the Loan Rate tended to move with the prime rate. However, it will also be seen that, since 1979, the dramatic developments in the latter two areas (collapsing uranium prices and enormous inventories

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Figure 1
HISTORICAL RELATIONSHIP BETWEEN THE
NUEXCO LOAN RATE AND THE US PRIME RATE*



*Source: US Federal Reserve System

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available for loan) have tended to overwhelm the influence of general interest rate movements.

Also, money markets are affected by inflation in a way that the uranium loan market is not. Interest rates in money markets are thought to be the sum of the "real interest rate", risk, and anticipated inflation. Anticipated inflation is included because in times of inflation, money returned will have a lower real value than money borrowed. But in the case of a uranium loan, the uranium returned to the lender will have the same intrinsic value as had the uranium borrowed. Thus, the variable of anticipated inflation is removed, and the uranium loan use charge rate reduces to the sum of the real interest rate and risk.

Elements of A Loan Transaction

The single most important and the fundamental concept underlying loan transactions has been and remains that the lender must perceive the potential transaction as virtually *risk-free*. That is, the lender should never find himself in a less advantageous position as a consequence of having made the loan in question. And the combination of risk-averse lenders (principally utilities) and low financial returns clearly makes it unattractive for prospective lenders to enter any transaction with the potential to prove troublesome or embarrassing at some later date. The financial incentives are simply too small, and, even were they greater, such risk taking would still be outside the normal business charter of utility companies.

While each loan may have its own unique characteristics, all loan transactions have certain basic elements.

- **Loan Material**—the quantity, form, and origin of the material borrowed.
- **Delivery Location**—the location at which the borrower elects to take delivery of the loan material.
- **Delivery Date**—the date on which the borrower elects to take delivery of the loan material.
- **Replacement Material**—material equivalent in quantity, form, and origin to the loan material.
- **Replacement Location**—the location at which the lender requires delivery of the replacement material.
- **Replacement Date**—the date on which the lender requires delivery of the replacement material.

■ **Loan Rate**—the annual interest rate utilized to calculate the loan fee.

■ **Loan Value**—the monetary value assigned to the loan material.

■ **Loan Fee**—the result of applying the loan rate to the loan value.

■ **Security**—provisions relating to the assurance of timely delivery of the replacement material or lender's recourse in the event that borrower fails to perform.

The first three elements tend to be driven by the borrower's needs, for presumably the borrower will only undertake the transaction if he can obtain what he wants, when and where he wants it. The second three elements are generally determined by the lender, usually based on where and when the replacement material is needed for the next step in processing.

Almost without exception, the loan transactions being concluded today are structured as direct, two-party deals between a lender and borrower. This is the case even if a broker or other intermediary has assisted in arranging the transaction. In the early 1970s, however, many loans, particularly those involving NUEXCO, were structured as tri-partite deals, with the contract being signed by the lender, the borrower, and the intermediary. The loan material went from the lender to the borrower through the intermediary. Most importantly for the intermediary, the loan fees were paid by the borrower to the intermediary, who, after deducting his fee, paid the balance to the lender. The replacement material followed the same route. But regardless of structure, the loan rate and the security provisions have always represented the commercial heart of the loan transaction.

A Model Loan Transaction

Given these elements, it is helpful to think in terms of a model or archetypical transaction as a reference for actual transactions. It is important to note that this is only a model, and that the prevailing terms for actual loans vary from time to time as market conditions change. Such a model would have the following features:

- The loan material could involve any quantity, form, or origin, but unusual combinations of these attributes would require rate adjustments.

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- The delivery location would be a North American or European conversion, enrichment, or fuel fabrication facility.
- The delivery date would typically be within three months of closing date.
- The replacement material would be identified in quantity, form, and national origin to the loan material. For example, if 100,000 pounds of Canadian-origin yellowcake were borrowed, 100,000 pounds of Canadian-origin yellowcake would be returned.
- The replacement location would be the same as the location of the loan material before delivery to the borrower.
- The replacement date defines the duration of the loan and would be in the range of 6 to 24 months.
- The loan rate would equal or approximate the then-current NUEXCO Loan Rate.
- The loan value would be equal to the relevant NUEXCO Market Value current at the time of the transaction.
- The loan fee would be payable in cash, quarterly or annually.
- The security provided to assure a borrower's performance could be any form that would satisfy the lender that the transaction would be virtually risk-free.

Commercial Variations

Variation from the model is the rule rather than the exception. As might be expected, variance in one area affects others, particularly with respect to the loan rate.

Duration

While most loans have a duration of 6 to 24 months, the borrower or lender occasionally wants a shorter or longer term. Shorter-term loans normally result in higher effective loan rates, for lenders typically require some minimum compensation for undertaking the transaction. For example, with a loan value of \$10.00 per pound U₃O₈ and an annual loan rate of 3.5%, a loan of 200,000 pounds U₃O₈ would return the lender less than \$6,000 per month, a scant return if the loan term were only a few months. If the lender required a minimum return of about \$50,000, and if the loan were repaid in six months time, the effective loan rate would have been about 5%.

Lenders will typically also insist on a minimum return when, as is often the case, the borrower has the choice of when to repay, subject only to some "not later than" date. Shorter-term loans are also apt to involve simpler security provisions, for there is less likelihood of significant changes in the value of the loan material.

Conversely, longer loan periods may, in some cases, result in lower loan rates which recognize the extended period during which the lender will receive an assured cash flow. Higher loan rates may also be appropriate in some cases for longer loan periods to compensate for a longer risk period. The security provisions for longer-term loans become more complex, because a longer loan term increases the chance that the value of the loan material may increase or decrease, perhaps substantially, requiring commensurate adjustments in the value of the borrower's security.

Replacement Material

Historically, replacement material has been identical, in terms of quantity, form, location, and origin, to the loan material. Over the past several years, it has become increasingly commonplace for the replacement material to differ from the loan material in one or more important aspects. Thus, a borrower may borrow yellowcake of one origin, and, at either the lender's or borrower's request, return yellowcake of another origin or form or at another location. For example, U₃O₈ has been borrowed and UF₆ returned, making it difficult to separate and value the loan rate and the conversion component. The two participants in such a transaction can themselves value the components differently, each achieving their own objectives. In an enriched product loan, the situation becomes more complex, for it is necessary to deal with the origin of both the SWU and the feed. In such cases, the role of traders becomes particularly useful by virtue of their ability to deal with multiple parties and complexity in general.

Replacement material that differs from loan material is the principal reason for loan rates that diverge from the NUEXCO Loan Rate, but all transactions are considered by NUEXCO in reaching its judgment as to the NUEXCO Loan Rate.

A final consideration relating to replacement material involves not replacing it at all. The right to close out loans, via a borrower's "call" or a lender's "put," while not common is not unknown. Loan fees paid prior to such a transaction may be applied, in whole or part, to the price of the material. Such variations also make it difficult to evaluate the real loan rate in the transaction.

BASIC CONSIDERATIONS**Loan Rates**

As previously noted, the loan fee is the result of applying the loan rate to the loan value. But, as also noted, loan fees may, under certain circumstances, be established as lump sums, or, in other cases, as an amount per quantity unit per time period. Thus, a loan fee of \$0.001 per pound U₃O₈ per day, based on a U₃O₈ value of \$10.00 per pound, equates to an annual loan rate of about 3.65 percent.

Loans are also sometimes repaid in kind (additional replacement material) or services. If in kind, the loan fee would usually be expressed in units of replacement material per time period, such as 1,000 pounds U₃O₈ equivalent per month.

Over the longer term, the level of loan rates has reflected the interaction among general interest rates, uranium prices, and the perceived supply/demand balance within the uranium market. But the loan market is both smaller (fewer participants) and less active (fewer transactions) than the conventional buying/selling arena, and, consequently, is less efficient, responding more slowly and with less precision to changing market conditions.

In a given transaction, the particular situations of individual lenders and borrowers can, at times, override market conditions. Thus, a producer with an immediate need to borrow a certain origin U₃O₈ at a specific converter, may find there is but a single potential lender of the needed material. If that lender, knowing he is a sole source, were to demand a loan rate that is twice the NUEXCO Loan Rate, the producer has a simple choice—pay the higher rate or forget the prospective deal.

Security

In the early 1970s when uranium prices were both relatively low and stable, loan transactions were something of a novelty and most were based on the full faith and credit of the borrower. The standard remedy was a so-called "hell-or-high-water" clause which provided that the lender could, if the replacement material was not delivered as scheduled, procure additional replacement material, the cost of which would be fully borne by the borrower. Such a remedy was suggested by similar provisions of the Uniform Commercial Code.

By the mid-1970s, however, lenders had become increasingly cautious in the face of sharply rising uranium prices and growing concerns about the availability of adequate long-term supplies. In the loan market, these concerns translated into security provisions more stringent than full faith and credit of the borrower. Other provisions

relating to the assurance of timely loan repayment or lender's recourse if the borrower failed to perform have included:

- letters of credit (L/C);
- performance bonds;
- security deposits;
- grant-of-production payments;
- liens on and assignments of interest in uranium, uranium properties or reserves, or borrowers' uranium purchase contracts;
- other security.

For a number of years, both lenders and borrowers of uranium did their very best to avoid involvement with commercial bankers and L/Cs. However, the irrevocable standby L/C has become the preferred form of security, and as lenders have become more insistent, it has also become the most common. Furthermore, it is not unusual for the lender to require that the value of an L/C securing a uranium loan be periodically adjusted, to ensure that its value remains equivalent to the market value of the loan material. Nevertheless, full faith and credit of the borrower or other equivalent security are often adequate as security, depending on the particulars of the deal.

Conclusion

Loan transactions, originally visualized as being relatively straightforward deals (borrow now, pay interest, return later), have evolved into increasingly sophisticated and complex arrangements which borrowers and lenders are using to achieve entirely different ends than replacement near-term supply. For their part, lenders are benefiting from the ability to obtain enhanced financial returns, and changes of origin, location, or form. Such transactions are also having a substantial market impact by helping to mobilize substantial, heretofore frozen, inventories, thereby increasing market supply and hastening the redistribution of these inventories. Loan transactions may not only increase in the future in size and number, but may include forms not common in today's market. Production planning by the producing segment of the industry must take into account the impact of the increased market supply from inventories of commodities and services, or the time of the ultimate swing in the supply/demand cycle will simply be deferred. ■

1989 NUCLEAR FUEL INDUSTRY DEVELOPMENTS

(Listed chronologically by region)

Africa

MARCH

- 1 The UN Security Council approved Resolution 435 establishing a plan for **Namibia's** independence, agreed to by Cuba, South Africa, and Angola in December 1988. The Security Council's approval was the final formality required.

APRIL

- 1 UN Resolution 435 went into effect, launching **Namibia's** transition to independence.

SEPTEMBER

- 6 F.W. de Klerk's National Party won a majority, albeit reduced, in **South Africa's** Parliamentary elections. Voting results clearly indicated the electorate had shifted to the left, thus improving the climate for political reform.
- 25 At its 1989 conference in Vienna, the IAEA resolved to consider and make a decision in 1990 on the suspension of **South Africa** from IAEA membership.

NOVEMBER

- 7-11 **Namibia** held its first free national elections, which determined how many seats each political group would hold in the constituent assembly charged with drafting a constitution. The South-West Africa People's Organization (SWAPO) won 57 percent of the vote, but failed to win the two-thirds majority required to write its own constitution.

Australia

JANUARY

- 3 British Petroleum Co. (BP) and Rio Tinto Zinc (RTZ) reached agreement for RTZ to acquire all of BP's mineral interests, including its 49-percent share in the **Olympic Dam** project.

MAY

- Late May BP and RTZ announced their agreement valuing BP's share of **Olympic Dam** at A\$800 million (approximately US\$600 million). Western Mining's first right of refusal to preempt RTZ expires at the end of September.

AUGUST

- 4 Western Mining filed a suit against **BP** seeking to invalidate BP's notice of intent to sell its 49 percent interest in the **Olympic Dam** project to RTZ.

SEPTEMBER

- 4 Primary Industries and Energy Minister John Kerin announced he had approved **ERA's** renegotiation of two uranium contracts with new floor prices of US\$26 per pound U₃O₈, indicating a significant shift in Australia's ten-year old floor price policy.
- 11 BP withdrew its notice of intent to sell its 49-percent share in **Olympic Dam** to RTZ.
- 26 Pioneer International announced it would sell all its mineral interests, including **Queensland Mines Ltd.**—the founder and developer of the Nabarlek deposit.

Europe—Eastern

MARCH

Mid-month As part of an overall government restructuring, **Yugoslavia's** new federal premier abolished the Commission of the Federal Executive Council for Atomic Energy (FEC), and announced a new regulatory organization would be established comprising technical experts and FEC members.

APRIL

20 The **USSR** Council of Ministers voted formally to cancel all RBMK (Chernobyl-type) reactors both planned and under construction. They also adopted plans to rebuild 14 reactors constructed in the 1970s to add safety equipment and improve technical specifications.

27 **Czechoslovakia** announced three new nuclear plant sites for development of the country's third generation of nuclear power.

MAY

15 The inaugural meeting of the World Association of Nuclear Operators (WANO) was held in **Moscow**. The new organization was formed to seek ways to prevent future nuclear accidents through the exchange of information.

12 **Hungary** announced plans to phase out by 1992 its operating uranium mines in the Mecsek mountains due to difficult geological conditions and rising operating losses.

JUNE

20 The **Yugoslavian** Parliament banned construction of additional nuclear plants or waste processing facilities.

JULY

4 The **USSR** has reorganized its nuclear ministry. The new Ministry for Nuclear Power, Engineering and Industry will be headed by Vitaly Federovich Konovalov.

SEPTEMBER

26 **Hungary** became the first Comecon country to adopt the new IAEA protocol on civil liability for nuclear accidents.

NOVEMBER

20 Canada and the **USSR** agreed to cooperate in nuclear technology development, and uranium exploration and development.

Europe—Western

JANUARY

12 The **French** government approved the restart of the 1,200-MWe Super-Phenix 1, which had been down since May 1987.

18 Siemens-Kraftwerk Union acquired two **West German** fuel fabricators—Reaktor-Brennelement-Union mbH (RBU) and Alkem GmbH—which together will be known as Siemens Brennelementewerk Hanau (SBH). The Minister of Environment approved an operating permit for the new division on January 18.

1989 DEVELOPMENTS

Europe—Western
(Continued)

FEBRUARY

- 16 The **United Kingdom, France, West Germany, Belgium, and Italy** signed a formal cooperative agreement for the development of commercial fast breeder reactors.

MARCH

- 8 **Switzerland's** lower house of Parliament approved a federal plan calling for the abandonment of the Kaiseraugst nuclear plant.
- 10 In response to the discovery that heavy water had been illegally rerouted to India, **Norway** passed a law banning all exports of heavy water except for small quantities to be used for research purposes.

APRIL

- 13 **Framatome and Kraftwerk Union (KWU)**, a division of Siemens, signed a formal accord to jointly develop and market PWRs through a 50-50 joint venture called Nuclear Power International (NPI).
- 27 The **Swiss** government rejected two referenda calling for moratoriums on nuclear power.

MAY

- 8 **Asea Brown Boveri AG (ABB) and Siemens AG** announced they would jointly develop high temperature reactors under the name HTR-GmbH Gesellschaft für Hochtemperaturreaktoren.
- 12 Neckarwestheim-2, the last LWR in **West Germany's** convoy program, entered commercial operation.
- 13 **CEGB's** 610-MWe Torness Point 2 AGR began commercial operation.
- 31 **DWK, the West German** utility consortium, announced it was cancelling the controversial Wackersdorf reprocessing plant under construction in Bavaria, and would seek spent fuel disposal arrangements at La Hague in France, or with BNFL in the UK.

JUNE

- 2 **Asea Brown Boveri and Westinghouse** announced plans to jointly market nuclear services in Europe.
- 15 Environmentalist groups almost doubled their seating through the **European Parliament** elections. Out of the Parliament's 518 seats, the Greens gained 19 seats for a total of 39, while the Socialists, the largest group in Parliament, gained 15 seats, bringing its total to 181. Although voter turnout was low (56%), the election results gave some indication of the political climate in Europe.

- Late June The **West German** government began soliciting bids for DM1.5 billion of its Offset stockpile.

JULY

- 7 Electricité de France asked the **French** government for permission to delay initial construction of its planned Civaux nuclear reactor until late 1991.

AUGUST

- 15 The **North Rhine-Westphalia** state government announced its decision to close the THTR-300 high-temperature gas reactor owned by Hochtemperatur-Kernkraftwerk GmbH (HKG).

Europe—Western

(Continued)

SEPTEMBER

- 8 **Urangesellschaft mgH (UG)** announced that the uranium trading activities of **STEAG Kernenergie GmbH**, a wholly-owned subsidiary of **STEAG AG**, would be transferred to **UG**.
- 14 **Framatome S.A.** announced the \$50 million acquisition of half of **Babcock & Wilcox's** nuclear services business. Through the new joint enterprise—**B&W Nuclear Service Co.**—**Framatome** will have direct access to the US market. The merger was also aimed at expanding **B&W's** scope of operations and competitiveness in the USA.

OCTOBER

- 18 Following a year-long study on the nation's nuclear industry, the **French** government reaffirmed its commitment to nuclear power, while announcing plans to reorganize some of its policies and operations.
- 19 A fire shut down **Spain's** Vandellós-1 plant. Although no radioactivity was released, the nuclear plant accident was the most serious to date in Spain, and has aroused much public concern.

NOVEMBER

- 9 The **United Kingdom's** Energy Secretary John Wakeman announced the exclusion of nuclear energy from the UK's electricity privatization program because of concerns about nuclear's high costs. The UK also cancelled three **PWRS** similar to **Sizewell-B**.
- 13 **Asea Brown Boveri Ltd. (ABB)** reported it would purchase **Combustion Engineering (CE)** for US\$40 per share, or approximately \$1.6 billion, and concentrate on expansion in the US nuclear market.
- 28 **British Nuclear Fuels Ltd. (BNFL)** announced it would establish a US subsidiary to vie for clean-up work at DOE's nuclear sites and to offer assistance in nuclear plant decommissioning.

DECEMBER

- 18 The **European Community** and the **USSR** signed an agreement to conduct joint research and development in nuclear power, concentrating on safety.
- 20 **Siemens KWU** and its affiliate **Advanced Nuclear Fuels Corporation (ANF)** announced the consolidation of both companies' nuclear plant activities under a new services organization within **ANF**.

Far East

FEBRUARY

- 10 **Japan's** Shimane 2, a 780-MWe BWR, began commercial operation.

MAY

- 18 **Japan's** Power Reactor & Nuclear Fuel Development Corp. commissioned the second unit of its prototype enrichment plant at Ningyo Toge. Like the first unit, **DOP-2** has a capacity of 100,000 SWU-per-year.

1989 DEVELOPMENTS

Far East

(Continued)

JUNE

- 22 Tomari 1, a 550-MWe PWR and **Japan's** 37th nuclear reactor, entered commercial operation.

JULY

- 23 The pronuclear Liberal Democratic Party lost its majority in **Japan's** Upper House elections. The Japan Socialist Party, which has an antinuclear platform, more than doubled its seating. This development may make further advancements of Japan's nuclear power program more difficult.

SEPTEMBER

- 27 Operations resumed at **Power Reactor & Nuclear Fuel Development Corp.**'s Tokai reprocessing plant, which had been closed since June 1988 for modifications.

OCTOBER

- 13 Korea Electric Power Company (KEPCO) announced plans to build three new nuclear power plants—one of a Canadian Candu design (construction to start in 1991), and two PWR's to begin construction in 1992.

NOVEMBER

- 3 **China** announced plans to construct several nuclear power plants between 1991 and 2000 to meet its rapidly rising electricity demand.
- 18 The **Japanese** government released a white paper promoting increased world reliance on nuclear power rather than fossil fuels because of environmental considerations.

DECEMBER

- 15 **Japan's** Nuclear Energy Commission met to discuss modifications to the nuclear plant construction plan through 2010.

North America

JANUARY

- 1 The US/Canada Free Trade Agreement went into effect.
- 11 The US **Supreme Court** upheld a Pennsylvania law barring utilities from recovering costs associated with abandoned nuclear power plants.
- 12 President Bush appointed Admiral James Watkins, a former commander in the Navy's nuclear submarine program, **US Secretary of Energy**.
- 23 The US **Supreme Court** upheld a state law barring utilities from raising rates to recover costs associated with abandoned nuclear plants.
- 25 US Sen. Wendall B. Ford (D-Ken) introduced S. 83 to the Senate establishing the amount of prior unrecovered government cost for enrichment services at \$364 million, and limiting the payback period to 20 years.

North America

(Continued)

JAN. (cont.)

- 27 The **US Producers** ended their four-year lawsuit against the US DOE by filing a Motion to Dismiss Without Prejudice in the USA District Court.

FEBRUARY

- 16 DOE announced a FY 1990 SWU price of \$122/SWU for its USEC holders.
- 22 Rep. Marilyn Lloyd (D-TN) introduced **HR 1100** barring US utilities from purchasing Soviet enrichment.
- 28 New York Governor Cuomo signed a new agreement with Long Island Lighting Co. to shut down the **Shoreham** nuclear plant. The agreement exempted legislator approval and left rate hike determinations to the Public Utility Commission.

MARCH

- 7 The **Environmental Protection Agency (EPA)** published its proposed rules for stricter radionuclide emission controls, which would dramatically elevate costs of uranium operations.
- 16 Baltimore Gas & Electric's **Calvert Cliffs Unit 2** became the first PWR in the world to complete a planned 24-month operating cycle. The unit's capacity factor during this period was approximately 98.5 percent.
- 17 Senator Pete Domenici (D-NM) introduced **uranium revitalization legislation** as an amendment to Senate Bill 83 introduced in January, which sets DOE's unrecovered enrichment costs at \$364 million.
- 28 **Cameco** announced an extensive reorganization plan in view of declining uranium prices and excess inventories worldwide. The plan included work reduction at the Blind River uranium refining plant and at the Port Hope conversion facility. In addition, Cameco announced the closure of its Rabbit Lake mine for a six-month period.

Late March **Malapai Resources Company** began production at its Christensen Ranch ISL project in Wyoming.

APRIL

- 1 Nineteen utilities announced full or partial cancellation of their DOE **USEC contracts**.
- 5 The Nuclear Regulatory Commission adopted **new nuclear plant licensing procedures** which call for early site approval, standardization of reactor designs, and issuance of a combined construction permit and conditional operating license.
- 13 **Mexico's** first nuclear power plant, Laguna Verde-1, a 654-MWe BWR, was connected to the grid.
- 20 The Nuclear Regulatory Commission unanimously approved a full-power operating license for the **Shoreham** nuclear plant, although LILCO, the plant's operator, agreed not to operate the plant above 5 percent power until LILCO's shareholders voted on the agreement (all were in favor of the sale).

MAY

- 26 The Nuclear Regulatory Commission issued Public Service Company of New Hampshire a low-power operating license for **Seabrook**, after intervenors failed to obtain a stay of the license.

1989 DEVELOPMENTS

North America

(Continued)

JUNE

- 6 California voters passed the first anti-nuclear ballot initiative in the USA, opposing further operation of Sacramento Municipal Utility District's **Rancho Seco** plant.
- 9 Urenco announced its joint venture—**Louisiana Energy Services**—with Duke Power Co., Graystone Corp. (a subsidiary of Northern States Power Co.), Louisiana Power & Light Co., and Fluor Daniel, Inc. to construct a 1.5 million SWU-per-year plant in Louisiana. Estimated to cost \$750 million, the plant is targeted for operation in 1996 and would be the first privately-owned enrichment facility in the USA.
- 13 **Seabrook** began low-power testing.
- 14 Commissioner Kenneth Carr was appointed **Chairman of the Nuclear Regulatory Commission**, replacing Lando Zech.

JULY

- 13 The **American Society of Mechanical Engineers** released a position paper on energy and the environment, recommending the US develop and promote domestic reprocessing.
- 18 Central Electricity Generating Board Exploration (CEGBE) purchased from Everest Minerals Corp. the controlling interest in the **Highland Uranium Project Joint Venture**, which owns a 75-percent interest in the Highland uranium mine in Wyoming.
- 20 The US Senate passed S.83, the **Uranium Enrichment Act of 1989**, covering reorganization of DOE's enrichment enterprise, uranium revitalization, and establishing a mill tailings fund, by 73 to 26.

AUGUST

- 10 Chevron announced it would shut down its **Mt. Taylor mine** in October unless a partner or purchaser could be found. Mt. Taylor production totalled over 1.7 million pounds U₃O₈ in 1988, or about 11 percent of total US production.
- 29 Due to the high cost of making necessary repairs, Public Service of Colorado announced it would shut down its **Fort St. Vrain** nuclear plant immediately, rather than in June 1990 as scheduled. Fort St. Vrain, the only operating gas-cooled reactor in the USA, became the first nuclear plant to have been shut down by a utility voluntarily.

SEPTEMBER

- 5 The US DOE announced it would provide \$50 million each to **Westinghouse Electric Co.** and **General Electric** to develop passively safe reactors.
- 14 DOE informed its USEC customers that it would lower its estimated **FY 1990 SWU ceiling price** by \$2 to \$118, due to savings in power costs.
- 26 Largely as a result of Chevron's decision to close its Mt. Taylor mine, **Homestake Mining** announced it would shut down its Grants, New Mexico mine and mill on December 1.

OCTOBER

- 13 **Freeport Uranium Recovery Co.** reported it would place its Sunshine Bridge mine on standby until the uranium market improves. Sunshine Bridge, located in Louisiana, has produced about 400 thousand pounds annually from by-product operations.

North America

(Continued)

OCT. (cont.)

- 23 The **US Department of Commerce** reported that sufficient uranium supplies exist to meet domestic requirements during a national emergency. Section 232 of the Atomic Energy Act requires this study when imports exceed 37.5 percent of actual US uranium requirements for two consecutive years.
- 24 An **NRC** spokesman said the agency planned to extend the operating lives of nuclear plants to 50 or 60 years. Although the Atomic Energy Act only allows 40-year licenses, there are no restrictions on extensions.
- 27 **Uranium Resources, Inc.** issued a press release confirming it would be purchased by Rio Algom Corp. (The sale later fell through.)

NOVEMBER

- 13 The Atomic Safety & Licensing Board found **Seabrook's** emergency plan "adequate and implementable and recommended that the NRC issue a full-power operating license.
- 20 **Umetco Minerals** announced a cutback in its uranium and vanadium activities in Western Colorado as well as its Eastern Utah milling operations. Umetco produced about 650 thousand pounds U₃O₈ in 1988.
- 20 **Canada** and the Soviet Union agreed to cooperate in nuclear technology development, uranium exploration and development.
- 28 **DOE** announced a seven-year delay in the operation of a permanent nuclear fuel waste repository. The repository will not begin operation before 2010.

DECEMBER

- 15 The \$4.5 million cleanup of **Union Carbide's** uranium mill tailings site in Green River, Utah was completed. This was the fifth site completed under the Uranium Mill Tailings Radiation Act of 1978.
- 15 **Cameco** has scheduled a four-month shutdown in mid-1990 at its Blind River refinery and Port Hope conversion plant due to deteriorating market conditions.
- 19 **Ontario Hydro** announced it would seek approval from a provincial environmental board to expand its nuclear capacity and build ten additional 881-MWe Candu plants to meet baseload demand through 2013.

South America

MAY

- 14 Carlos Saul Menem, a staunch advocate for an independent nuclear fuel cycle for **Argentina**, was elected President of Argentina.

AUGUST

- 24 President Menem concluded a three-day visit to **Brazil** by signing several cooperative agreements including an extension to a joint nuclear development pact. This visit indicates a continued effort to improve relations between the two countries.

South America

(Continued)

OCTOBER

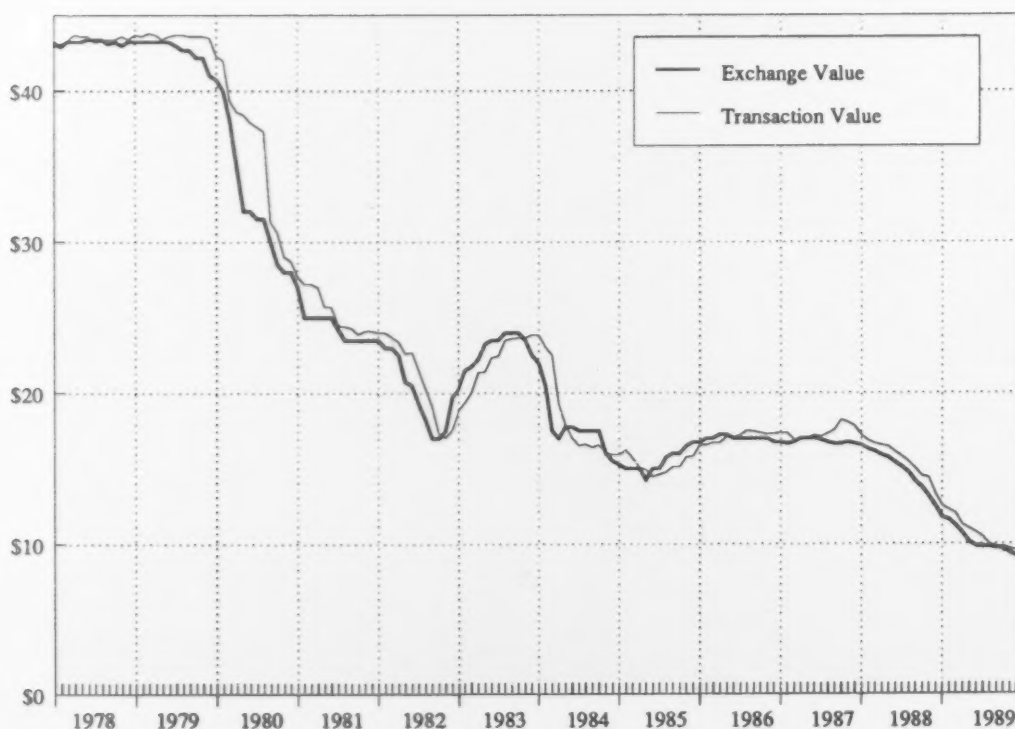
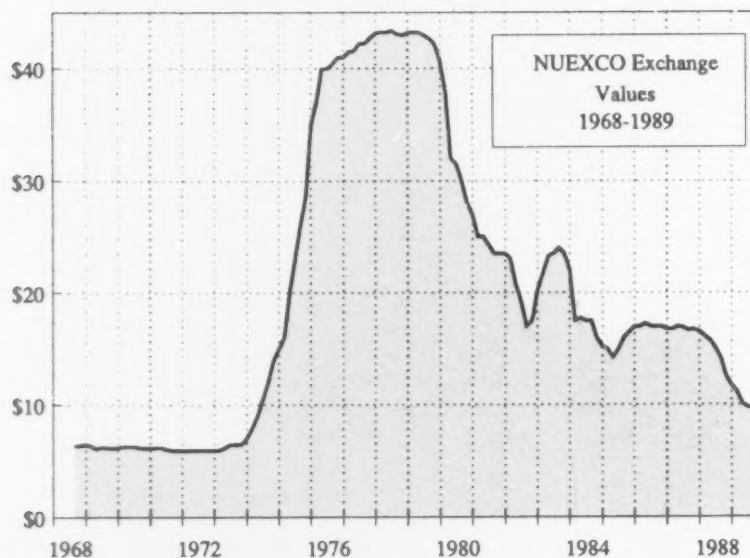
- 17 A **Brazilian** court ordered Angra-1 to remain shut down temporarily after refueling, following a class action suit led by Green party members.

DECEMBER

- 17 Fernando Collor de Mello was elected **President of Brazil**. Because the center-right politician supports private business development, this could benefit industrial efforts in the nuclear field.
- 25 **Argentina's** Atomic Energy Commission shut down the troubled Los Gigantes concentrating plant due to poor operations and major overestimates of yellowcake reserves in the deposit.

HISTORICAL MARKET DATA

**NUEXCO Historical
Exchange and
Transaction Values**
(In US Dollars/Pound U.O.)



HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00

HISTORICAL US PREMIUM (Relative to the Exchange Value)												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	None	

HISTORICAL UF ₆ VALUES												
Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50

HISTORICAL MARKET DATA

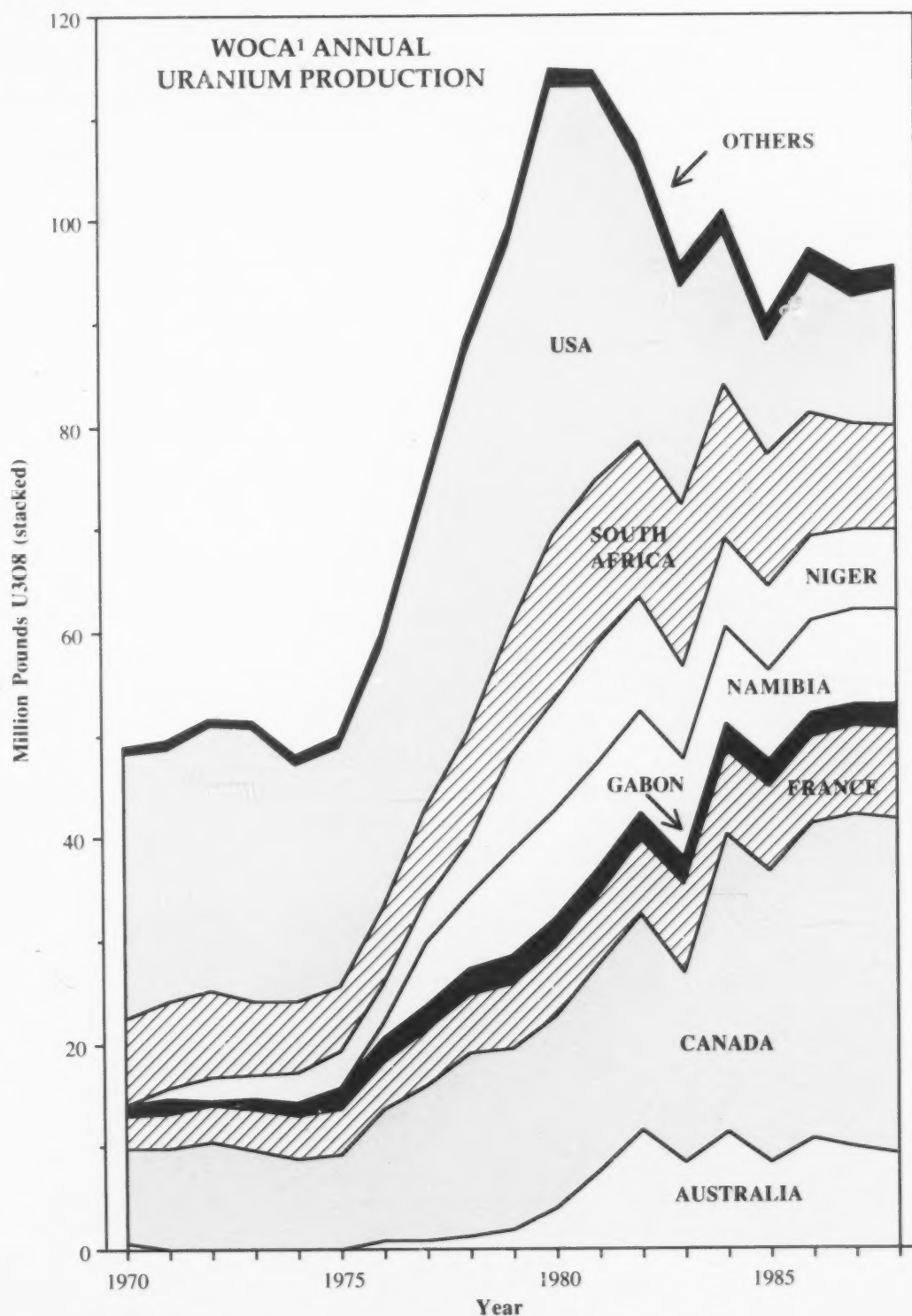
HISTORICAL US UF₆ PREMIUM (Relative to the UF₆ Value) Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	None	

HISTORICAL TRANSACTION VALUES Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40

HISTORICAL CONVERSION VALUES Determined as of the last day of the month indicated (\$US/lb U as UF ₆)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65

HISTORICAL SWU VALUES (at 0.30 Percent Tails Assay) Determined as of the last day of the month indicated (\$US per SWU)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54

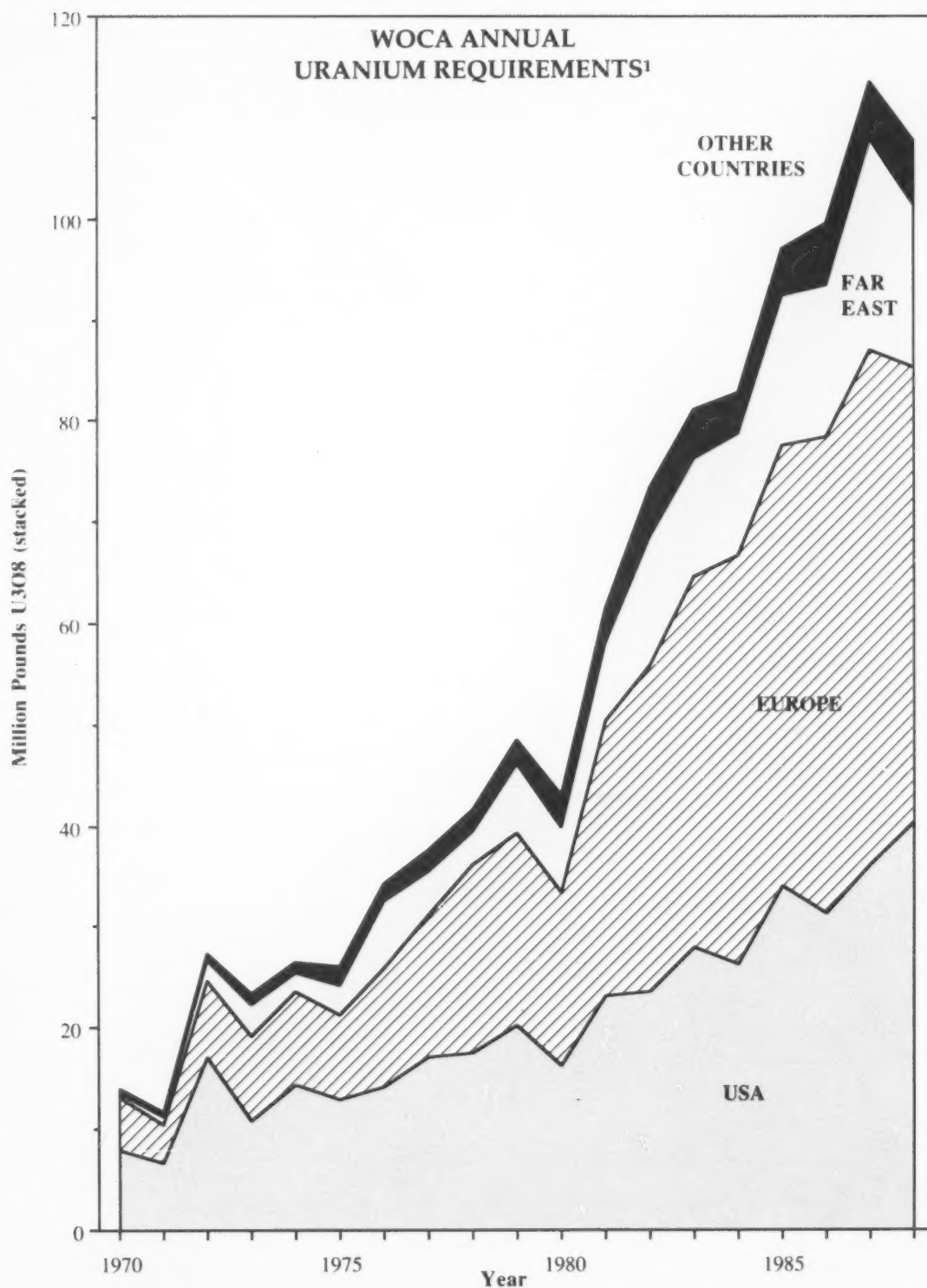
HISTORICAL MARKET DATA



¹ WOCA = World Outside of Centrally-Planned Economic Areas.

² World production in 1988 totalled 96.8 million pounds (Australia—9.3; Canada—32.3; France—8.9; Gabon—2.4; Namibia—9.2; Niger—7.8; South Africa—9.9; USA—13.5; Other—3.5).

HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual plant completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

HISTORICAL MARKET DATA

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	16.10	3.6	n/a	1.2
1977	29.9	27.8	19.75	5.6	n/a	4.0
1978	37.0	31.6	21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agents

³ Includes imports by domestic utilities and domestic suppliers

HISTORICAL MARKET DATA

**VOLUME AND PRICE OF URANIUM DELIVERIES
TO THE EUROPEAN COMMUNITY¹**
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC ² (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ^{3,4}		Spot Contracts ^{3,4}	
			Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈	Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,500	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65R	\$16.13R

R = Revised

¹The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

²The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

⁴Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

GOVERNMENT STATISTICS

AUSTRALIA					
		Consumer Price Index ¹ (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ² (1984/1985 = 100)	Average Weekly Earnings — Adult Males — Australia (Australian dollars) ⁶	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates ³ (June 1985=100)
1980	Avg.	95.8	83.1	—	140.8 ⁵
1981	Avg.	105.0	85.9	—	154.1 ⁵
1982	Avg.	116.7	89.0	—	174.9 ⁵
1983	Avg.	128.5	96.9	—	181.9 ⁵
1984	Avg.	133.6	98.0	—	194.4 ⁵
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
Jan	1989	—	110.6	—	122.2
Feb	1989	—	111.2	521.90	122.2
Mar	1989	188.1R	114.9	—	123.1
Apr	1989	—	117.5	—	123.2
May	1989	—	118.6	531.50P	123.7R
June	1989	192.8	119.9	—	123.8R
July	1989	—	120.1	—	124.9R
Aug	1989	—	119.2	—	124.9
Sept	1989	197.2	117.7	—	125.0
Oct	1989	—	—	—	125.0

P = Preliminary R = Revised since last month

¹Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

²Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

³Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

⁴Monthly data for the period 1967 to 1986 appear in Report 233.

⁵Base: June 1976 = 100.

⁶Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

GOVERNMENT STATISTICS

CANADA								
Wage-earner Data: Average Hourly Earnings (C\$) ²								
		Industrial Products Price Index: All Commodities ¹ (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells ³ (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	138.2	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	143.8	20.91	18.51	16.95	13.17	13.77
Jan	1989	130.7	146.8	21.22	19.45	18.14	13.75	13.82
Feb	1989	130.8	147.8	22.05	19.51	18.26	13.79	13.89
Mar	1989	131.3	148.5	21.90	19.65	18.35	13.62	14.10
Apr	1989	131.3	149.0	22.37	19.80	18.40	13.57	14.16
May	1989	131.4	150.5	21.89	20.02	18.17	13.76	14.27
June	1989	131.4	151.3	21.89	20.02	18.17	13.76	13.22
July	1989	131.3	152.3	21.67	19.60	17.96	13.57	12.98
Aug	1989	131.2	152.4	20.97	19.76	18.24	13.52	14.30
Sept	1989	130.9	152.6	21.97	20.61R	18.73	13.68R	14.83R
Oct	1989	130.8	153.2	22.26P	20.58P	18.69P	13.99P	14.75P
Nov	1989	130.4	153.7	—	—	—	—	—

P = Preliminary R = Revised since last month

¹Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

²Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

³Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA							
		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand) ¹	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100) ²	Consumer Price Index ³ (1985 = 100)	Production Price Index All Groups ⁴ (1980 = 100)	Total Employment in Mining and Quarrying ⁵	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) ⁵
1980	Avg.	35.53	—	51.9	100.0	709,042	2,237,689
1981	Avg.	41.89	—	59.8	113.6	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	129.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	143.1	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	155.1	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	181.2	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	216.6	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	246.8	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	279.3	705,355	7,774,054
Jan	1989	—	—	166.8	299.8	714,593	704,320
Feb	1989	—	—	168.2	305.4	696,329	669,983
Mar	1989	112.29	262.8	170.9	310.0	702,746	695,843
Apr	1989	—	—	173.1	315.0	658,677	634,344
May	1989	—	—	175.9	319.6	706,056	721,263
June	1989	113.76	267.0	177.7	320.9	706,810	720,586
July	1989	—	—	179.3	324.0	711,648	775,002
Aug	1989	—	—	181.8	327.5R	703,812	793,475
Sept	1989	119.76	280.2	183.4	329.3	—	—
Oct	1989	—	—	185.1	333.1	—	—
Nov	1989	—	—	187.0	—	—	—
P = Preliminary R = Revised since last month							
¹ Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.							
² Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.							
³ Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 236.							
⁴ Central Statistical Service, Pretoria: All commodities for consumption in South Africa.							
⁵ Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.							

GOVERNMENT STATISTICS

UNITED STATES									
						Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴			
		Producer Price Index ¹		Consumer Price Index ²	GNP Implicit Price Deflator ³				
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
Jan	1989	109.4	110.5	121.1	—	13.80	13.49	12.85	10.27
Feb	1989	110.1	110.8	121.6	—	13.66	13.48	12.88	10.26
Mar	1989	110.5	111.5	122.3	125.4	13.71	13.51	12.91	10.30
Apr	1989	111.8	112.3	123.1	—	13.68	13.65	12.92	10.31
May	1989	112.1	113.2	123.8	—	13.60	13.57	12.98	10.33
June	1989	112.4	112.9	124.1	126.0	13.62	13.66	12.98	10.37
July	1989	112.2	112.8R	124.4	—	13.70	13.75	13.12	10.41
Aug	1989	111.4	112.0	124.6	—	13.64	13.72	13.08	10.40
Sept	1989	111.9	112.3	125.0	126.8	13.70R	13.99R	13.18	10.47R
Oct	1989	112.4	112.7	125.6	—	13.80P	13.89P	13.24R	10.44R
Nov	1989	112.2	112.7	125.9	—	—	—	13.29P	10.50P

P = Preliminary R = Revised since last month

¹US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

²US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

³US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

⁴US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

CALENDAR

Nuclear Industry Calendar

1990

- | | |
|-------------|---|
| Jan. 22-26 | Nuclear Fuel Cycle Committee (Las Vegas, Nevada), sponsored by the American Society for Testing and Materials. Contact Ms. Katharine Schaaf at the ASTM at 1-215-299-5529. |
| Mar. 4-8 | 7th Pacific Basin Conference (Sheraton Harbor Island Hotel, San Diego, California), sponsored by the ANS. Contact the ANS Meetings Department at 1-312-352-6611. |
| Mar. 12-15 | Radioactive Material Transportation Basic Workshop (Oak Ridge, Tennessee). Contact Teresa Yearwood at 1-615-482-9031. |
| Mar. 25-28 | Fuel Cycle '90 Conference (Opryland Hotel, Nashville, Tennessee), sponsored by the US Council for Energy Awareness. Contact the USCEA Conference Office at 1-202-293-0770. |
| Apr. 8-12 | First Annual International High-Level Radioactive Waste Management Conference (Caesar's Palace Hotel, Las Vegas, Nevada), sponsored by the American Nuclear Society and American Society of Civil Engineers. Contact the ANS at Meetings Department at 1-312 352-6611. |
| Apr. 9-11 | 23rd JAIF Annual Conference (Kyoto, Japan). Contact Ms. Sachie Sugoh, Dept. of Planning and International Affairs, JAIF, at 03-508-9056. |
| Apr. 22-25 | INFO '90 (Westin Hotel, Dallas, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770. |
| Sept. 5-7 | Uranium Institute 15th Annual Symposium (London, United Kingdom). Contact the UI at 44-1-225-0308. |
| Sept. 16-19 | Uranium Seminar '90 (Hyatt Regency, San Antonio, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770. |
| Nov. 11-14 | Nuclear Energy Forum (Washington Hilton, Washington, D.C.), sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611. |

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1989
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NUEXCO MONTHLY REPORT

January 1990, No. 257

* * *

EXECUTIVE SUMMARY

(All data as of December 31, 1989)

Exchange Value
\$9.00, down \$0.20

The **Exchange Value** is **\$9.00** per pound U_3O_8 , down \$0.20 from last month.

UF₆ Value
\$26.50, down \$1.25

The **UF₆ Value** is **\$26.50** per kg U as UF₆, down \$1.25 from last month.

**Uranium Sales;
Supply and
Demand**

Nine recent **natural uranium** sales and **one enriched uranium product** sale is reported, involving approximately **2.0 million** pounds equivalent U_3O_8 . Eight of these sales involved spot or near-term delivery and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **4.8 million** pounds U_3O_8 equivalent, down approximately 3.5 million pounds since last month. Active spot and near-term **uranium demand** totals **1.8 million** pounds, down about 900 thousand pounds from last month. The spot and near-term **supply-demand ratio**, at **2.8 to 1**, fell from last month's ratio of 3.1 to 1.

Transaction Value
\$9.40, down \$0.15

The **Transaction Value** is **\$9.40** per pound U_3O_8 , down \$0.15 from last month. The calculation includes 21 transactions involving a total of approximately 4.2 million pounds U_3O_8 equivalent and covers a period of three months.

Loan Rate
3.5%, unchanged

The **Loan Rate** is **3.5 percent** per annum, unchanged. Three natural uranium loans are reported.

Conversion Value
\$1.65, down \$0.10

The **Conversion Value** is **\$1.65** per pound U as UF₆, down \$0.10 since last month. No transactions for conversion services are reported.

SWU Value
\$54, down \$3

The **SWU Value** dropped \$3 to **\$54** per SWU. One enrichment sale is reported involving EUP. Active supply declined to 730 thousand SWU, while active demand remained at 400 thousand SWU.

* * *

**New York Times
Supports Nuclear
Power**

The *New York Times*, in a surprising editorial dated December 12, called for the revival of the US nuclear power industry. For your interest, we have reprinted the full editorial on page 13.

**1989 Nuclear
Fuel Industry
Developments**

NUEXCO has compiled and expanded its monthly recap of industry developments to provide an overview of many major developments affecting the nuclear fuel market in 1989. We hope you will find this review helpful.

Uranium Loans

Beginning next month, NUEXCO's historical market data section, which follows our feature articles, will include historical NUEXCO Loan Values. Accordingly, this month we discuss the uranium loan market, and present historical NUEXCO Loan Values on page 17.

NUEXCO REPORT 257 FIGURES OF THE MONTH (December 31, 1989)	This Month (Report 257)	Last Month (Report 256)	12 Months Ago (Report 245)
Exchange Value (\$US per pound U ₃ O ₈)	9.00	9.20	11.75
US Premium for the Exchange Value (\$US per pound U ₃ O ₈)	—	—	—
UF₆ Value (\$US per kg U as UF ₆)	26.50	27.75	35.50
US Premium for the UF ₆ Value (\$US per kg U as UF ₆)	—	—	—
Transaction Value (\$US per pound U ₃ O ₈ equivalent)	9.40	9.55	12.50
Loan Rate (Per Annum)	3.5%	3.5%	3.5%
Conversion Value (\$US per pound U as UF ₆)	1.65	1.75	1.95
Near-Term Uranium Supply ¹ (millions of pounds U ₃ O ₈)	4.8	8.3	8.1
Near-Term Uranium Demand ² (millions of pounds U ₃ O ₈)	1.8	2.6	2.4
Near-Term Supply-Demand Ratio	2.8	3.1	3.3
Recent Uranium Sales: ³			
Number of Transactions	10	8	13
Quantity of Material (Millions of pounds U ₃ O ₈ equivalent)	2.0	2.2	3.3
Nuexco SWU Value: (\$US per SWU):			
at 0.3 tails assay	54	57	65
US DOE SWU Prices: (\$US per SWU)			
USEC	118.00 ⁴	118.00 ⁴	117.00 ⁹
AFC	153.00 ⁶	153.00 ⁶	153.00 ⁶
Requirements	157.00 ⁶	157.00 ⁶	157.00 ⁶
Incentive Price	90.00 ⁷	90.00 ⁷	90.00 ⁷
Market Value of Enriched UF₆ ⁸ : (\$US per kg U as UF ₆)			
2.5 w/o U ₂₃₅	282	294	352
3.0 w/o U ₂₃₅	363	379	453
3.5 w/o U ₂₃₅	446	465	555
4.0 w/o U ₂₃₅	529	552	658

¹Active inquiries to sell, for delivery within 12 months after contract signing.

²Active inquiries to purchase, for delivery within 12 months after contract signing.

³Uranium sales only; does not include loans, conversion, or SWU transactions.

⁴Provisional price for DOE fiscal year 1990.

⁵Effective since 10/1/86.

⁶Effective since 10/1/84.

⁷Effective since 10/1/86, for up to 30% of annual requirements.

⁸Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

⁹Effective since 10/1/87 to 9/31/89.



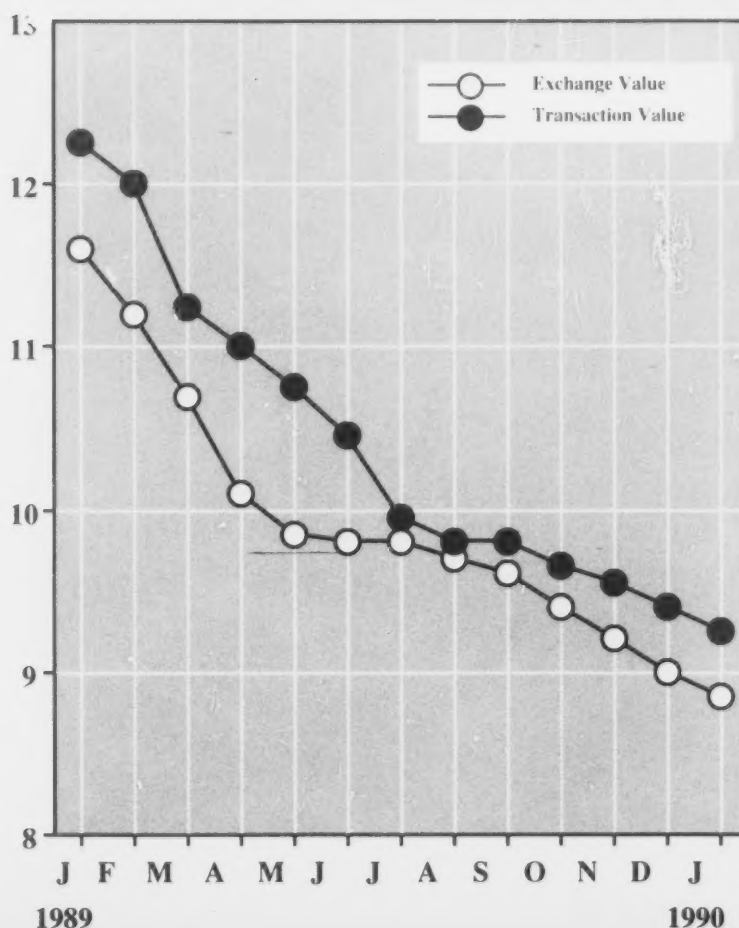
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NUEXCO Information Services Company

NUEXCO Asia, Limited

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Charles H. Peterson, President

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Hans W. Vogt, Managing Director

Charles H. Peterson, President

Gerald L. Murdock, Managing Director

Robert L. Bovey, President

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MESSAGE TO THE READERS AND CUSTOMERS OF NUEXCO

A Follow-up Message from Oren L. Benton,
Owner and Chairman of NUEXCO,
on NUEXCO's Publication of the NUEXCO Exchange Value
(Included as an insert to NUEXCO Report No. 258)

In my *Message to the Readers and Customers of NUEXCO* published in the June 1989 Monthly Report, I commented on NUEXCO's activities of publishing the NUEXCO Exchange Value (NEV) and trading as a principal in nuclear fuel. I affirmed therein my intention to have NUEXCO continue its activities as a trading, brokerage, consulting, and information services company (including publication of its judgment of spot market prices) because I believed such to be in not only NUEXCO's, but the nuclear fuel industry's best interest. I also stated in my earlier Message that I had directed the formation of a group to examine and discuss the processes, procedures, and results bearing upon the integrity of the NEV and its publication by NUEXCO.

A Task Force for the above purpose was established at the end of July. Membership included J.R. Wolcott as chairman (formerly Chairman of NUEXCO and with General Electric for over 20 years prior thereto), H.E. Bose (independent legal counsel with over 20 years' experience in nuclear fuel contracting, representing General Electric and later NUEXCO), O.J.C. Runnalls (Immediate Past Chairman of the Canadian Nuclear Association and formerly with Atomic Energy of Canada, Ltd., Uranium Canada, Ltd., as well as previous Senior Advisor to the Department of Energy, Mines and Resources in Ottawa), and J.C.C. Stewart (Chairman of the British Nuclear Forum and formerly Managing Director, Production Group, for the United Kingdom Atomic Energy Authority). Messrs. Wolcott, Runnalls, and Stewart are members of NUEXCO's International Advisory Committee.

This Task Force intentionally comprised persons of (1) senior stature, whose integrity was above question; (2) substantial industry experience, who could appreciate both the importance and the sensitivity of the matter; (3) varied nationalities, to avoid any appearance of national bias; and (4) varied professional backgrounds, to bring different perspectives to bear. The desire for objectivity had to be balanced with a need to recognize the proprietary nature of the subject.

The Task Force members extensively interviewed NUEXCO employees, observed the NEV processes in action (in some cases on an undisclosed basis), reviewed results, talked with certain customers, and took other actions in their investigations as they chose. The Task Force had no restrictions on its focus or the extent of its access to data, personnel, or actions of NUEXCO.



This Task Force has presented to me its extensive written report, and its detailed recommendations will be given serious consideration. The basic conclusions of the Task Force are quoted as follows:

- " 1. The quality of the NUEXCO Exchange Value is as sound as one can reasonably expect. We found no evidence that past or current judgments produced bias in favor of NUEXCO. The process provides for inputs from many individuals, located in numerous, separate offices, and participants concerned with different aspects of different transactions. Judgment dominated by any person, or special interest group, would not be practical in the present diversified, decentralized system.
2. The importance of a consistently-used, well-administered process is such that increased use of written policies, procedures, and records is recommended to ensure that operations are consistently carried out in accordance with Company intent and in a verifiable manner.
3. The Task Force questions whether continued NEV publication serves NUEXCO's interest. Both NUEXCO and the industry served have changed substantially since publication began 20 years ago. We recommend (a) a reexamination of purpose in the context of current and future needs, and (b) reevaluation of the advantages and disadvantages as compared to possible alternatives."

I am satisfied that the findings concerning the soundness of the NEV are valid, and am pleased to report the Task Force conclusions. The more detailed recommendations are under review and, after further study, many will be put into practice. As a follow-up to the Task Force process, I have asked that one or more of such members periodically observe the NEV process to gain further from this experience and independence.

Recognizing that the NEV is important to both NUEXCO and those who have used it, I wish to personally assure you that so long as the NEV is published by NUEXCO, its integrity and validity will be preserved to the best of our ability. As recommended by the Task Force, the question of whether to continue publication of the NEV will be considered in a more deliberate manner. NUEXCO has no present plans to discontinue its publication of the NEV. We will appreciate any comments you may wish to make on the question of publication, or any other NEV-related matter. You may also direct any comments to any of the Task Force members in person or to the group as follows:

J.R. Wolcott, NEV Task Force
Three Park Central, Suite 1045
1515 Arapahoe Street
Denver, Colorado 80202
USA

Finally, I wish to publicly express my appreciation to the Task Force as a group and to its members individually, for their commitment to this study and their thoughtful approach to this sensitive issue.



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1990 MARKET STUDIES

In 1990, NUEXCO will publish two market study reports, differing only in the amount of detail provided. One report will be entitled *Market Analysis and Price Trend Projections for Nuclear Fuel Materials and Services - 1990 - Summary Report*. It will be very similar in scope and content to last year's joint report with Pickard, Lowe and Garrick, Inc.

The other report will be entitled *Market Analysis and Price Trend Projections for Nuclear Fuel Materials and Services - 1990 - Extended Coverage Report*. It will contain more detail, and will be similar in depth to last year's *Uranium Market Study*.

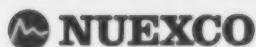
Both reports will contain the following chapters:

1. Introduction
2. World Installed Nuclear Electric Capacity and Performance
3. World Inflation and Currency Exchange
4. World Uranium Market
5. World Conversion Market
6. World Uranium Enrichment Market
7. World LWR Fuel Fabrication Market
8. Spent Fuel Disposal

AVAILABILITY OF THE REPORTS

NUEXCO plans to have the *Extended Coverage Report* available for mailing by the end of April and the *Summary Report* by the middle of May.

For additional information about either of these reports, please contact Treva King or another NUEXCO Information Services representative at 303/899-4500.



NUEXCO MONTHLY REPORT

February 1990, No. 258

* * *

EXECUTIVE SUMMARY

(All data as of January 31, 1990)

Exchange Value
\$8.85, down \$0.15

The **Exchange Value** is \$8.85 per pound U_3O_8 , down \$0.15 from last month.

UF₆ Value
\$25.90, down \$0.60

The **UF₆ Value** is \$25.90 per kg U as UF₆, down \$0.60 from last month.

**Uranium Sales;
Supply and
Demand**

Six recent **natural uranium** sales are reported, involving approximately **5.1 million** pounds equivalent U_3O_8 . Two of these sales involved spot or near-term delivery and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **6.2 million** pounds U_3O_8 equivalent, and active spot and near-term **uranium demand** totals **2.5 million** pounds. This compares to the 6.0 million pound supply and 3.2 million pound demand published in the December 31, 1989 Notice to Subscribers. The spot and near-term **supply-demand ratio** is **2.5 to 1** for January 31, 1990.

Transaction Value
\$9.25, down \$0.15

The **Transaction Value** is \$9.25 per pound U_3O_8 , down \$0.15 from last month. The calculation includes 17 transactions involving a total of approximately 4.0 million pounds U_3O_8 equivalent and covers a period of three months.

Loan Rate
3.5%, unchanged

The **Loan Rate** is **3.5 percent** per annum, unchanged. Two natural uranium loans are reported.

Conversion Value
\$1.50, down \$0.15

The **Conversion Value** is \$1.50 per pound U as UF₆, down \$0.15 since last month. Two transactions for conversion services are reported.

SWU Value
\$54, unchanged

The **SWU Value** is unchanged at \$54 per SWU. Three SWU sales are reported. Active supply declined to 665 thousand SWU, while active demand remained at 400 thousand SWU.

* * *

**Swedish Nuclear
Phaseout Under
Review**

With the January reorganization of the Swedish government and the establishment of a committee to review energy policy, the 1995 target date to begin the phaseout of nuclear power will probably be postponed.

**Soviet Uranium
Supply Capability**

Uranium in the Soviet Union is usually recovered through by-product or co-product mining operations or by in-situ leaching. With substantial excess capacity available to produce for export, the Soviet Union is mounting a vigorous effort to expand its nuclear fuel trade with Western Europe, North America, and the Far East.

**Uranium Require-
ments of Developing
Countries**

Between 1990 and 2005, developing countries will require over 173 million pounds equivalent U_3O_8 for their nuclear industries. Although these cumulative uranium requirements are expected to account for less than eight percent of total world requirements, many of these countries are expressing renewed interest in nuclear power.

NUEXCO MONTHLY REPORT 258 FIGURES OF THE MONTH (January, 31, 1990)	This Month (Report 258)	Last Month (Report 257)	12 Months Ago (Report 246)
Exchange Value (\$US per pound U ₃ O ₈)	8.85	9.00	11.60
UF₆ Value (\$US per kg U as UF ₆)	25.90	26.50	34.75
Transaction Value (\$US per pound U ₃ O ₈ equivalent)	9.25	9.40	12.25
Loan Rate (Per Annum)	3.5%	3.5%	3.5%
Conversion Value (\$US per pound U as UF ₆)	1.50	1.65	1.95
Near-Term Uranium Supply ¹ (millions of pounds U ₃ O ₈)	6.2	4.8	8.7
Near-Term Uranium Demand ² (millions of pounds U ₃ O ₈)	2.5	1.8	1.2
Near-Term Supply-Demand Ratio	2.5	2.8	7.0
Recent Uranium Sales: ³			
Number of Transactions	6	10	15
Quantity of Material (Millions of pounds U ₃ O ₈ equivalent)	5.1	2.0	18.4
Nuexco SWU Value: (\$US per SWU)			
at 0.3 tails assay	54	54	65
US DOE SWU Prices: (\$US per SWU)			
USEC	117.85 ⁴	118.00 ⁵	117.00 ⁶
AFC	153.00 ⁷	153.00 ⁷	153.00 ⁷
Requirements	157.00 ⁷	157.00 ⁷	157.00 ⁷
Incentive Price	90.00 ⁸	90.00 ⁸	90.00 ⁸
Market Value of Enriched UF₆ ⁹ : (\$US per kg U as UF ₆)			
2.5 w/o U ₂₃₅	279	282	350
3.0 w/o U ₂₃₅	359	363	450
3.5 w/o U ₂₃₅	440	446	552
4.0 w/o U ₂₃₅	523	529	655

¹Active inquiries to sell, for delivery within 12 months after contract signing.

²Active inquiries to purchase, for delivery within 12 months after contract signing.

³Uranium sales only; does not include loans, conversion, or SWU transactions.

⁴Effective 10/1/89 to 9/31/90.

⁵Provisional price for DOE fiscal year 1990.

⁶Effective from 10/1/87 to 9/31/89.

⁷Effective since 10/1/84.

⁸Effective since 10/1/86, for up to 30% of annual requirements.

⁹Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

NUEXCO

Monthly Report

February 1990
No. 258

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Other NUEXCO Publications:
Annual Review, Uranium
Market Study; International
Directory of Nuclear Utilities
(IDNU), International Directory
of Uranium Producers (IDUP)

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To Our Readers

Effective January 1, 1990, NuTranS, a nuclear transportation and services organization, was added to the CONCORD group of companies involved in the international nuclear fuel industry. Nuclear Transportation & Services Company, doing business as NuTranS, will operate out of our Washington, D.C. office. Robert L. Bovey will continue to serve as President of NuTranS.

* * *

This month Katie Bowen will be transferring from Geneva, Switzerland to Denver, Colorado, where she will be involved in uranium trading as well as other CONCORD trading and business development activities. Since joining NUEXCO's San Francisco operations in 1978, Katie helped establish a NUEXCO office in New York 1981, and has been based in Europe since opening that office in 1982.

* * *

Accompanying this month's Report is a *Message to the Readers and Customers of NUEXCO* from Oren L. Benton, owner and Chairman of NUEXCO, which follows up his *Message* published in the June 1989 Report. As mentioned in his original *Message*, Mr. Benton established a Task Force to "study steps which could be taken to further assure that the integrity of the NUEXCO Exchange Value is preserved for the benefit of the industry." Mr. Benton's current *Message* reports the Task Force findings with respect to the validity of the NEV.

MARKET VALUES SUMMARY January 31, 1990

Market Values	This Month (Report 258)	Active Supply* (thousands of pounds U ₃ O ₈ equivalent)	Active Demand* (thousands of pounds U ₃ O ₈ equivalent)
EXCHANGE VALUE ¹	\$8.85/lb U ₃ O ₈	6,200**	2,502**
UF ₆ VALUE ²	\$25.90/kg U as UF ₆		
LOAN RATE ³	3.5%/annum	6,650	0
CONVERSION VALUE ⁴	\$1.50/lb U as UF ₆	1,240	0
SWU VALUE ⁵ 0.3 tails assay:	\$54/SWU	665	400
TRANSACTION VALUE ⁶	\$9.25 Per Pound U ₃ O ₈	4.0 Million Pounds	17 Transactions
* Supply and demand tables in the <i>Current Market Data</i> section of this Report detail the numbers for each category. ** Includes uranium concentrates and uranium hexafluoride.		DERIVATIONS AND COMMENTS - All Market Values are based on: - Data from recently completed transactions. - Data from pending transactions. - Firm bids to buy or borrow, and firm offers to sell or lend. - Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend. - Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values. - In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers. - The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values. - For the SWU Value, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the NUEXCO Exchange Value and Conversion Value determined as of the same date. - In calculating the Transaction Value, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined. - The sample time for the Transaction Value is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.	
DEFINITIONS ¹ The Exchange Value is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated. ² The UF₆ Value is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated. ³ The Loan Rate is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated. ⁴ The Conversion Value is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated. ⁵ The SWU Value is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated. ⁶ The Transaction Value is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in: - Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date; - At least ten transactions; - Transactions involving a sum total of at least 2 million pounds U₃O₈ equivalent.			

PRICING

NATURAL URANIUM AND SPOT CONVERSION

(All data as of January 31, 1990)

The first month of the 1990s witnessed a continuation of the trend of steadily falling prices that began in late 1987. The spot market volume for uranium included only two near-term sales totalling nearly 900 thousand pounds U₃O₈ equivalent. However, five long-term uranium sales were concluded this past month; four involved U₃O₈, and one involved UF₆.

Additionally, two conversion sales, two loans, and three enrichment sales are reported.

The **Exchange Value** continued to fall in January and reached **\$8.85** per pound U₃O₈, a \$0.15 drop from December 31. Relatively few spot sales occurred during January, due mostly to the lack of near term interest among buyers. Nevertheless, the downward trend continued as aggressive sellers sought to take advantage of any sales opportunities. The two spot sales totalling approximately 900 thousand pounds U₃O₈, occurred at or near the January 31, 1990 Exchange Value. They both involved utilities and intermediaries as the buyers and sellers.

Total natural uranium sales exceeded five million pounds U₃O₈ equivalent in six transactions, including the two described above. NUEXCO has been unable to verify the six million pound sale reported in the January 31 Notice to Subscribers, therefore it is not included in this month's transaction volume. The four remaining transactions involved long-term delivery and totalled more than four million pounds U₃O₈.

* * *

The **UF₆ Value** declined \$0.60 to **\$25.90** as supply continues to exceed demand. There has been little near-term activity lately as buyers appear to be waiting for prices to drop still further, but sellers appear equally hesitant to offer even at current levels.

Excess supply continues to exert downward price pressure in the near-term, and broad market recognition of this situation magnifies this downward pressure. One long-term sale took place involving UF₆ between an intermediary and a utility.

* * *

The **Transaction Value** dropped \$0.15 to **\$9.25** based on 17 qualifying sales involving 4.0 million pounds U₃O₈ equivalent over a three-month period.

* * *

Active Supply of natural uranium increased this month to **6.2 million** pounds U₃O₈ equivalent. With an **Active Demand** of **2.5 million** pounds, the **Supply/Demand Ratio** is **2.5** this month.

The supply and demand data known as of the last day of December 1989 were published in the December 31 Notice to Subscribers. The supply and demand tables published in the January Monthly Report (No. 257) reflected the subsequent reclassification of three projects from Active to Inactive.

* * *

The **Loan Rate** remains at **3.5 percent** per annum. Two loans were reported for January totalling nearly one million pounds U₃O₈ equivalent. One occurred at or near the January 31, 1990 Loan Rate. The other also took place at a rate near the January 31, 1990 Loan Rate, and involved a number of special considerations. Under certain circumstances, those special considerations could lead one to evaluate that loan at a lower rate.

* * *

PRICING

The **Conversion Value** declined to **\$1.50** from \$1.65. Two conversion sales were concluded in January at or near the January 31, 1990 Conversion Value; both involved intermediaries as sellers and utilities as buyers. Excess UF₆ supply and deconversion swaps are exerting continuing and substantial pressure on conversion prices, and the UF₆ Value remains below the sum of its component values (the Exchange Value and the Conversion Value).

* * *

The **SWU Value** remains at **\$54** per SWU. Three SWU sales are reported involving two European utilities and one US utility as buyers. One sale qualified as a spot transaction, and the other two were for later delivery. These three transactions totalled approximately 300 thousand SWU.

The SWU supply declined from 730 thousand SWU last month to 665 thousand SWU but still remains plentiful compared to demand. One major US utility continues to evaluate EUP offers. In addition, two more US utilities are soliciting offers for SWU. Decisions on all three of these offers are expected in the next month. ■

CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹						
Country (currency)	per lb U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Jan 31, 1990)	Last Month (Dec 31, 1989)	12 Months Ago (Jan 31, 1989)	This Month (Jan 31, 1990)	Last Month (Dec 31, 1989)	12 Months Ago (Jan 31, 1989)
Australia (dollar)	11.58	11.33	13.17	30.10	29.44	34.25
Belgium (comm. franc)	313.27	319.60	453.48	814.44	830.89	1,179
Canada (dollar)	10.52	10.41	13.71	27.34	27.07	35.63
EEC (ecu)	7.28	7.48	10.36	18.94	19.43	26.93
Finland (markka)	35.49	36.30	49.91	92.26	94.38	129.76
France (franc)	51.14	52.08	73.60	132.96	135.40	191.35
Italy (lira)	11,204	11,390	15,823	29,128	29,610	41,137
Japan (yen)	1,286	1,296	1,499	3,343	3,370	3,898
Netherlands (guilder)	16.99	17.17	24.43	44.18	44.64	63.50
So. Africa (comm. rand)	22.55	22.83	27.86	58.62	59.34	72.42
Spain (peseta)	967.11	985.11	1,341	2,514	2,561	3,486
Sweden (krona)	54.90	55.83	73.46	142.73	145.15	190.99
Switzerland (franc)	13.31	13.90	18.42	34.60	36.13	47.88
UK (pound)	5.28	5.62	6.60	13.73	14.61	17.16
US (dollar)	8.85	9.00	11.60	23.01	23.40	30.16
West Germany (mark)	15.06	15.23	21.62	39.16	39.60	56.20

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES ¹						
Country (currency)	per lb U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Jan 31, 1990)	Last Month (Dec 31, 1989)	12 Months Ago (Jan 31, 1989)	This Month (Jan 31, 1990)	Last Month (Dec 31, 1989)	12 Months Ago (Jan 31, 1989)
Australia (dollar)	12.10	11.83	13.91	31.46	30.75	36.17
Belgium (comm. franc)	327.43	333.81	478.89	851.25	867.82	1,245
Canada (dollar)	10.99	10.88	14.47	28.58	28.27	37.63
EEC (ecu)	7.61	7.81	10.94	19.79	20.30	28.44
Finland (markka)	37.09	37.92	52.71	96.43	98.58	137.04
France (franc)	53.46	54.40	77.73	138.97	141.42	202.08
Italy (lira)	11,710	11,896	16,710	30,444	30,926	43,442
Japan (yen)	1,344	1,354	1,584	3,494	3,519	4,117
Netherlands (guilder)	17.76	17.93	25.79	46.17	46.62	67.06
So. Africa (comm. rand)	23.57	23.84	29.42	61.27	61.98	76.48
Spain (peseta)	1,011	1,029	1,416	2,628	2,675	3,682
Sweden (krona)	57.38	58.31	77.58	149.18	151.60	201.69
Switzerland (franc)	13.91	14.52	19.45	36.17	37.74	50.56
UK (pound)	5.52	5.87	6.97	14.35	15.26	18.12
US (dollar)	9.25	9.40	12.25	24.05	24.44	31.85
West Germany (mark)	15.74	15.91	22.83	40.93	41.36	59.38

¹ Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

CURRENT MARKET DATA
**CONVERSION VALUE EXPRESSED IN SELECTED
PRODUCER & CONSUMER CURRENCIES¹**

Country (currency)	per lb U ₃ O ₈ as Concentrates			per kg U as Concentrates		
	This Month (Jan 31, 1990)	Last Month (Dec 31, 1989)	12 Months Ago (Dec 31, 1989)	This Month (Jan 31, 1990)	Last Month (Dec 31, 1989)	12 Months Ago (Jan 31, 1989)
Australia (dollar)	1.96	2.08	2.21	4.33	4.58	4.88
Belgium (comm. franc)	53.10	58.59	76.23	117.06	129.18	168.06
Canada (dollar)	1.78	1.91	2.30	3.93	4.21	5.08
EEC (ecu)	1.23	1.37	1.74	2.72	3.02	3.84
Finland (markka)	6.01	6.66	8.39	13.26	14.67	18.50
France (franc)	8.67	9.55	12.37	19.11	21.05	27.28
Italy (lira)	1,899	2,088	2,660	4,187	4,603	5,864
Japan (yen)	217.96	237.62	252.07	480.52	523.85	555.71
Netherlands (guilder)	2.88	3.15	4.11	6.35	6.94	9.05
So. Africa (comm. rand)	3.82	4.18	4.68	8.43	9.23	10.32
Spain (peseta)	163.92	180.60	225.43	361.37	398.16	497.00
Sweden (krona)	9.31	10.24	12.35	20.51	22.57	27.23
Switzerland (franc)	2.26	2.55	3.10	4.97	5.62	6.82
UK (pound)	.89	1.03	1.11	1.97	2.27	2.45
US (dollar)	1.50	1.65	1.95	3.31	3.64	4.30
West Germany (mark)	2.55	2.79	3.63	5.63	6.16	8.01

**SWU VALUE AND UF₆ VALUE EXPRESSED IN SELECTED
PRODUCER & CONSUMER CURRENCIES¹**

Country (currency)	SWU Value at 0.30% Tails Assay			UF ₆ Value per kg U as UF ₆		
	This Month (Jan 31, 1990)	Last Month (Dec 31, 1989)	12 Months Ago (Jan 31, 1989)	This Month (Jan 31, 1990)	Last Month (Dec 31, 1989)	12 Months Ago (Jan 31, 1989)
Australia (dollar)	70.63	67.95	73.82	33.87	33.34	39.46
Belgium (comm. franc)	1,912	1,918	2,541	916.81	941.05	1,358
Canada (dollar)	64.18	62.48	76.80	30.78	30.66	41.06
EEC (ecu)	44.45	44.85	58.04	21.31	22.01	31.02
Finland (markka)	216.54	217.83	279.69	103.85	106.89	149.52
France (franc)	312.07	312.50	412.44	149.67	153.35	220.49
Italy (lira)	68,363	68,337	88,665	32,789	33,536	47,401
Japan (yen)	7,847	7,777	8,402	3,763	3,816	4,492
Netherlands (guilder)	103.69	103.01	136.87	49.73	50.55	73.17
So. Africa (comm. rand)	137.58	136.95	156.10	65.98	67.20	83.45
Spain (peseta)	5,901	5,911	7,514	2,830	2,901	4,017
Sweden (krona)	334.99	334.99	411.65	160.66	164.39	220.07
Switzerland (franc)	81.22	83.38	103.19	38.95	40.92	55.16
UK (pound)	32.22	33.73	36.98	15.45	16.55	19.77
US (dollar)	54.00	54.00	65.00	25.90	26.50	34.75
West Germany (mark)	91.91	91.40	121.13	44.08	44.85	64.75

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.



CURRENT MARKET DATA

RECENT TRANSACTIONS

URANIUM SALES ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U ₃ O ₈ equivalent)	Approximate Price Range ² as Percent of Current Exchange or UF ₆ Value	Seller	Buyer	Remarks
4719	1990	101-300	98-102	Utility	R ³	
4725	1993-97	1,001-3,000	See Remarks	R ³	Utility	Base Price Escalated
4727	1993-97	1,001-3,000	See Remarks	R ³	Utility	Base Price Escalated
4731	1990	601-1,000	98-102	Intermediary	Intermediary	
4732	1990-95	1,001-3,000	See Remarks	Intermediary	Utility	Price Related to Market
4734	1991-94	601-1,000	See Remarks	Intermediary	Utility	UF ₆ , Base Price Escalated
¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information. ² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range. ³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.						

CURRENT MARKET DATA

LOAN TRANSACTIONS¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U₃O₈ equivalent)	Approximate Price Range² as Percent of Current Loan Rate	Lender	Borrower	Remarks
4726	1990	301-600	98-102	Intermediary	R ³	
4730	1990	301-600	98-102 ⁴	Intermediary	Utility	
CONVERSION SERVICES SPOT MARKET SALES¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U equivalent)	Approximate Price Range² as Percent of Current C.V.	Seller	Buyer	Remarks
4720	1990	101-300	98-102	Intermediary	Utility	
4728	1990	101-300	93-97	Intermediary	Utility	
ENRICHMENT SERVICES SECONDARY MARKET SALES¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity⁵ (thousand SWUs)	Approximate Price Range² as Percent of Current SWU Value⁶	Seller	Buyer	Remarks
4723	1991-93	101-300	R ³	Producer	Utility	
4733	1990	50-100	98-102	Intermediary	Utility	
4735	1991	50-100	98-102	Intermediary	Utility	
¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information. ² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range. ³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality. ⁴ This rate could be evaluated at less than 3.5 percent under certain circumstances. ⁵ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 % tails assay. ⁶ Prices are usually normalized to 0.30% tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.						

CURRENT MARKET DATA

URANIUM SUPPLY (January 31, 1990)			
Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Spot or Near-term²	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
88-1096A*	965	—	1990, UF ₆
89-1001*	1,300	1,300 per year	1990-93, UF ₆
89-1180	1,000	—	1990
89-1188	60	—	1990
89-1201*	2,000	2,000 per year	1990-93
89-1252	375	375 per year	1990-96
89-7000A	500	—	1990, UF ₆
Total	6,200		
INACTIVE			
89-1029	1,200	300 per year	1990-98
89-1076	500	250 per year	1990 on
89-1128	1,130	—	1990, U ₃ O ₈ /UF ₆
89-1156	200	—	1990
89-1173*	1,000	—	1990
89-1209	400	400 per year	1990-93
90-1000A*	655	—	1990, UF ₆
90-1003*	2,000	—	1990
87-1000	—	600 per year	1991-95
87-1123	—	1,000 per year	1990 on
88-1157	—	1,000 per year	1990 on, UF ₆
Total	7,085		
* New or revised since last month.			
¹ Measured from the date of this Report.			
² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.			
Projects removed since last month: 87-1005, 87-1109, 89-1194.			

CURRENT MARKET DATA

URANIUM DEMAND (January 31, 1990)			
Delivery Period¹ (Thousand Pounds of U₃O₈)			
NUEXCO Project Number	Spot or Near-term²	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
89-1183	400	—	1990
89-1218	1,000	1,000 per year	1990-93
89-1229*	100	—	1990
90-1001	350	—	1990
90-1008*	132	—	1990
90-1009*	260	—	1990, UF ₆
90-1015*	260	—	1990, UF ₆
88-1227	—	1,600	1990-95, U ₃ O ₈ /UF ₆
89-1090	—	150 per year	1991-96
89-1172	—	500 per year	1992 on
89-1176	—	600 per year	1991-96
89-1192	—	1,200	1992-97
89-1233	—	160	1991, UF ₆
89-1236	—	250	1991-94, U ₃ O ₈ /UF ₆
89-1242	—	75 per year	1992-94
89-1254	—	270 per year	1991-2000
89-1256	—	200 per year	1991-94
89-1260	—	250 per year	1992-94
90-1017*	—	500	1991
Total	2,502		
INACTIVE			
89-1067	500	—	1990
89-1163	1,000	—	1990
89-1175	170	170 per year	1990-91
Total	1,670		
[*] New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 89-1167, 89-1187, 89-1237, 89-1258.			

CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND (January 31, 1990)			
NUEXCO Project Number	Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)		Remarks
	Within 1 Year	Beyond 1 Year	
Available for Loan:			
ACTIVE			
88-1182	4,000	—	U ₃ O ₈ /UF ₆
89-1186	200	—	U ₃ O ₈
89-1225	700	—	U ₃ O ₈
89-1248	750	—	U ₃ O ₈
90-1016*	1,000	—	U ₃ O ₈
Total	6,650		
INACTIVE			
None reported			
Inquiries to Borrow:			
No inquiries to borrow are reported			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 87-1167, 89-1077, 89-1196, 89-1206.			

CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND (January 31, 1990)			
Delivery Period¹ (Thousand Pounds of U as UF₆)			
NUEXCO Project Number	Within 3 Years	Beyond 3 Years	Remarks
Available for Sale			
ACTIVE			
89-7000C	400	—	
89-7001A	440	—	
89-7002*	400	—	
Total	1,240		
INACTIVE			
<i>None reported</i>			
Inquiries to Purchase			
ACTIVE			
89-1245*	—	5,000	
Total			
INACTIVE			
<i>None reported</i>			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 89-1251.			



CURRENT MARKET DATA

SWU SUPPLY AND DEMAND (January 31, 1990)			
Delivery Period ¹ (Thousand SWUs)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
88-1082*	100	—	1990
88-1096B*	140	—	1990, UF6e
89-7000B	300	—	1990
89-7001B	125	—	1990
Total	665		
INACTIVE			
88-1210*	200	200 per year	1990-93
90-1000B*	150	—	1990, UF6e
Total	350		
Inquiries to Purchase			
ACTIVE			
88-1236	250	—	1990-94
89-1243	150	—	1990
88-1061	—	500	1991-95
89-1262	—	120 per year	1996-99
Total	400		
INACTIVE			
89-1043	50	—	1990
89-1047	—	600	1991-95
Total	50		
* New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 87-1128, 88-1200, 89-1203.			

RECENT DEVELOPMENTS

NAMIBIA

Namibian Independence Date Set

On January 31, eleven days ahead of schedule, the Namibia's Constituent Assembly formally established March 21 as the date for Namibian Independence. The Assembly, elected less than three months ago, has also almost completed drafting the nation's first constitution. Only seventeen clauses remain to be written by March 21.

Touted as being one of the most liberal in Africa, the constitution would establish Namibia as a sovereign republic founded on the principles of democracy. It would abolish capital punishment, making Namibia the only African nation without the death sentence, and would include an enforceable bill of rights.

Despite fears that the South West Africa People's Organization (SWAPO), with a 57-percent majority in the Assembly, would strive to incorporate its own language in the constitution, very little controversy actually arose during the drafting. SWAPO made a number of concessions, however, such as allowing a political system of proportional representation, dropping preventive detention, and placing restrictions on certain powers of the Presidency. This latter issue was only recently resolved, as SWAPO's leader Sam Nujoma is almost certain to be named President.

South Africa is expected to approve the independence timetable, and US sanctions against imports of Namibian uranium should be lifted on March 21, by means of a Presidential Executive Order. ■

SWEDEN

Nuclear Phaseout Plans Under Review

As the onset of Sweden's planned nuclear energy phaseout approaches, Sweden is reassessing its energy policy. Faced with increasing demand for electricity, yet legislatively barred from adding generating capacity from fossil fuels or hydropower, the 1980 public decision to completely eliminate nuclear power by 2010 no longer appears feasible. In addition, the 1988 Parliamentary decision to shut down the first two of Sweden's 12 plants in 1995 is under scrutiny, and time to construct their replacement capacity extremely limited.

The issue has caused dissent within the ruling Social Democratic Party (SDP), and resulted in heavily publicized debates on energy policy in the fall of 1989. In October, the government established a committee (the "Group of Four") to reconcile the opposing views of the ruling Social Democratic Party and labor groups on a national energy policy. Appointed to the Group of Four were:

- Ingvar Carlsson, Prime Minister;
- Birgitta Dahl, Minister of Environment and Energy;
- Rune Molin, Vice Chairman of the Federation of Labor Unions;
- Stig Malm, Chairman of the Federation of Labor Unions.

On January 9, Prime Minister Carlsson announced a reorganization of the government, and transferred energy matters from the Ministry of Environment and Energy to the Ministry of Industry, headed by Rune Molin. Birgitta Dahl, formerly in charge of Environment and Energy, was charged with heading the new Ministry of Environment.

RECENT DEVELOPMENTS

Molin led the Social Democratic Party's anti-nuclear referendum in 1980, and although he continues to defend his earlier promise to phase out nuclear power, he no longer specifies when it will take place. Neither Molin nor Dahl will confirm the 1988 Parliamentary decision to begin the phaseout in 1996, and Molin has said that "nuclear power shall be phased out when possible considering employment and welfare."

The future of the SDP—more specifically its reelection in September 1991—hinges on developing a national energy policy acceptable to both the government and the labor unions. The SDP has very little time, since, in order to gain the support of most Party members, an energy policy must be agreed upon before the Congress of the SDP commences in September 1990. The Group of Four has said an agreement can be expected in April.

There are indications that the Group of Four may be considering not only whether the phaseout should begin in 1995, but whether it should occur at all. Following a meeting of leaders of Nordic Social Democratic Parties and labor unions, the Danish daily newspaper *Politiken* reported on January 19 that the closure of Barseback

nuclear power plant was "hanging by a thread." Prime Minister Carlsson stated that each Parliament session was independent of earlier ones, and thus decisions made previously were not binding on successor Parliaments. He added that the Swedish government was under pressure to entirely abandon the phaseout, and that it was contemplating postponing the phaseout's commencement by three years.

According to a November 1989 public survey by SIFO, a well-known Swedish public polling institute, a majority of the public now opposes the government policy. Approximately 53 percent of the public support the use of nuclear power beyond 2010, while 25 percent believe nuclear power should not be phased out at all. In addition, the public has confidence in the safety of Swedish nuclear plants, and also believes in the safe disposal of nuclear waste.

A clarification of the party line should be forthcoming in 1990, and although it will probably include delaying the phaseout, it is unlikely to acknowledge yet that nuclear energy is an indispensable part of Sweden's energy mix. ■

RECENT DEVELOPMENTS

WASHINGTON FOCUS

Congress reconvened on January 23, but most of Washington's January news involves the Administration. DOE sent two letters to USEC customers, awarded a contract for the independent financial review of the enrichment program, and released a plan for demonstrating AVLIS by 1992. A General Accounting Office (GAO) report investigating the impact of imports of Soviet EUP into the US was made public. Both Congress and the administration are reportedly considering a full-scope US-Soviet Agreement for Nuclear Cooperation. Finally, published reports indicate Congress may consider ending the customs user fee which levies a charge of 0.17% on the value of all imported goods. The fee is felt to violate the General Agreement on Tariffs and Trade (GATT) and is not based on recovering actual Customs costs for processing a good. The fee brings the Treasury over \$700 million per year, but the business community plans to lobby hard for its outright elimination or a change in authority to collect the fee based on actual costs.

Congressional Agenda

Looking ahead at the second session of the 101st Congress, budget hearings will take precedence over most other legislative business early in the year, but both the Senate and the House of Representatives have taken up Clean Air Act Amendments bills. In the air toxics section, which includes radionuclide emissions, the debate will center around dual regulation. The Sen. Alan K. Simpson (R-WY) amendment eliminates EPA authority under the Clean Air Act for NRC-regulated facilities. Sen. George J. Mitchell (D-ME), during the holiday recess, noted that this amendment would prevent states from passing and enforcing stricter radionuclide standards. (Table 1 presents a summary of current and final radionuclide emission rules which has been corrected from the table printed on page 14 of last month's Report.) Other nuclear issues which will probably receive Congressional attention

Table 1
SUMMARY OF CURRENT AND FINAL RULES
 (Corrected from last month)

Source Category	Number of Facilities	Current Rules	New Rules
DOE facilities	45	25 mrem/yr	10 mrem/yr EDE ¹
NRC licensees	6,000	25 mrem/yr	10 mrem/yr EDE ¹
Nuclear reactors and support facilities	135	25 mrem/yr	10 mrem/yr EDE ¹
Underground uranium mines	15	Bulkheads	10 mrem/yr EDE ¹
Uranium tailings (disposal)	46	20 pCi/m ² -s radon	20 pCi/m ² -s radon
Uranium tailings (operations)	4	Close within 6 years and apply new technology	20 pCi/m ² -s radon Close unlined piles
Uranium tailings (new construction)	0	Phased/continuous disposal	Phased/continuous disposal
DOE radon sources	5	No rule	20 pCi/m ² -s
Phosphogypsum stacks	40	No rule	20 pCi/m ² -s
Elemental phosphorus plants	5	21 Ci/yr Po-210	2 Ci/yr Po-210
High-level nuclear waste facilities	0	No rule	No rule
Coal-fired boilers	1,500	No rule	No rule
Surface uranium mines	2	No rule	No rule

Source: ANS Nuclear News, December 1989

¹Effective dose equivalent

RECENT DEVELOPMENTS

DOE Activities:

USEC

this year are: resolving the high-level waste repository siting impasse, promoting advanced reactor technologies and standardization, restructuring the uranium enrichment program, and reorganizing the NRC.

■ In an attempt to respond to its customers' desire for flexibility, DOE sent out two letters this month to USEC holders. On January 11 DOE mailed utilities a supplemental agreement to their US contracts which allows the customer an additional 30 days to confirm the specific assay if the product is below 4.5% or until day 120 if the order specifies a standard assay (2.0, 2.8, 3.4, 4.0 and 4.45 w/o U235). On January 22, DOE announced it would waive for one year the April 1, 1990 notice for FY 2000 deliveries required under the US contract.

Enrichment Restructuring

■ DOE also announced the awarding of a \$2.5-million contract to Smith Barney for an independent financial review of the Department's uranium enrichment business. This contract will have three subcontractors—Coopers & Lybrand, Skadden, Arps, Slate, Meagher & Flom, and Nuclear Assurance Corporation. Smith Barney must submit its final report by mid-May. DOE hopes the report will generate enough interest in Congress, particularly in the House of Representatives, so that hearings to consider restructuring the enterprise will proceed.

AVLIS

■ On January 19, DOE released its plan for the "Demonstration, Transition and Deployment of AVLIS." The plan develops an industrial access program for the technology in 1990, which will be followed by the selection of a commercial deployment contractor in 1991. It also describes the milestones necessary to demonstrate AVLIS technology at plant scale by September 1992. DOE projects costs of \$550 million to demonstrate the technology by November 1992 when a deployment decision will be made. Predeployment activities (none of which have been initiated yet) include site selection, engineering design efforts, the National Environmental Protection Act (NEPA) documentation, and Nuclear Regulatory Commission (NRC) licensing. The plan, which is based on eventual construction of a nine-million SWU capacity plant, is said to show a return on investment of between 9 and 20 percent if DOE or a government corporation deploys the plant, or 17-24 percent if a private company deploys it. No justification for these numbers, however, was released with the report.

FY 1991 Budget

■ President Bush submitted his budget to Congress on January 29th. In a press briefing the same day DOE's Assistant Secretary for Nuclear Energy William Young presented an overview of the department's nuclear budget. The budget request for uranium enrichment increased from \$1.412 billion in FY 90 to \$1.480 billion for FY 91. Young indicated that the environmentally-related accounts of the enrichment budget request are 50-percent higher than last year. AVLIS receives an increase from \$132 million to \$154.5 million. It is clear that the government's decision not to proceed with the Special Isotopic Separation program (SIS), which last year DOE admitted was financially linked to AVLIS, will affect the schedule and funding for AVLIS this year. As partial payment of the \$364 million debt, \$29 million is requested, and a Decontamination and Decommissioning (D&D) fund is established with \$50 million.

RECENT DEVELOPMENTS***Soviet Enrichment Imports***

The total nuclear energy budget request increased from \$2.417 billion to \$2.539 billion. The nuclear energy R&D budget increased from \$341.8 million to \$357.8 million, but advanced reactor R&D actually decreases from \$58.7 million to \$47 million. Young hopes the design certification program will result in one large (1,200-MWe) ALWR design certification by 1991. Congressional hearings on DOE's budget will begin in late February and continue through March. It is likely DOE's budget allocations will change before Congress gives its final approval.

Rep. Marilyn Lloyd (D-TN) released a GAO study concerning utilities' use of Soviet enrichment and its impact on the US market. The GAO concluded that no Soviet uranium, and a relatively small amount of enriched uranium, was imported directly into the USA. However, it found that Soviet SWU coming into the European market had lowered prices and stimulated US purchases of other enrichment services. GAO could not find any evidence that utilities were "flag swapping" to conceal purchases of Soviet enrichment. The report notes that the Soviet Union is increasing its efforts to sell SWU to Western customers to earn the foreign exchange required for continued development.

US-Soviet Nuclear Cooperation

Both the administration and Congress may consider broadening the scope of US-Soviet relations on nuclear activities this year. A Congressional Research Service report published December 13, 1989 discusses the merits of a full-scope US-USSR Agreement for Nuclear Cooperation. The report noted that the first nuclear agreement which allowed some scientific and technical cooperation on the peaceful uses of nuclear power was signed in 1973. The original 1973 agreement covered cooperation in three areas: controlled thermonuclear fusion; fast breeder reactors; and research on basic theoretical physics. Cooperation increased substantially after the Chernobyl accident in 1986. Although the current agreement expired December 20, 1989, renegotiations are underway and there is some talk of expanding the scope of the agreement.

The report notes the Soviet Union collaborated with the USA on the Non-Proliferation Treaty, and also allows the IAEA to inspect some of its civilian facilities. The Soviet Union also permits IAEA safeguards to be applied to nuclear materials and equipment for export. Even during times of strained bilateral relations the report notes "The Soviet Union continued periodic non-proliferation meetings with the USA."

There is a continuing debate within the government about whether technology transfer to the Soviet Union benefits or harms US national security. Whether Congress or the administration will actually pursue this idea remains to be seen. ■

RECENT DEVELOPMENTS

Nuclear Fuel Industry Developments

December

- 22 Citing non-compliance with current safety regulations, the **North Rhine-Westphalia** State government regulators **shut down** the **Würgassen BWR**. Preussenelektra AG (Preag), the plant's owner, retaliated by filing suit against the State for ordering the closure. The matter is not expected to be resolved for some time, and the plant, the only remaining nuclear power plant in North Rhine-Westphalia, will remain closed.
- 27 **Poland** placed a one-year hold on further construction of its **Zarnowiec** nuclear station due to economic uncertainties. The country plans to revise its energy policy in the interim, and is under pressure to hold a public referendum on nuclear energy's future role in Poland.

January

- 4 **Rio Algom, Ltd.** announced the **shutdown** of its **Quirke** and **Panel** mines at Elliot Lake in early 1991 due to depressed uranium prices and low-grade ores. Together, Quirke and Panel accounted for about 75 percent of Rio Algom's 1988 production of six million pounds U₃O₈.
- 8 Eight months ahead of schedule, Philadelphia Electric Company's **Limerick 2** entered **commercial operation**.
- 9 As part of the reorganization of the **Swedish Government**, Rune Molin was appointed Minister of Industry and charged with energy matters. Although committed to the eventual **nuclear phaseout**, Molin concedes that 1995 is too early for the phaseout to commence. (See article on page 13).
- 10 **Argentina's Atucha 1** reentered service after being down nearly a year and a half for repairs. The 335-MWe PHWR will be limited to 50 percent-of capacity for the next few months.
- 12 **Chevron Resources** ceased mining and production at its **Mt. Taylor** mine in New Mexico, noting that uranium would have to be selling for around \$20 per pound for the mine to remain open. Mt. Taylor was New Mexico's last active uranium mine; twelve years ago New Mexico had 55.
- Kennecott Corp.** signed a **letter of intent** with **Crested Corp.** and its parent company **US Energy**, to jointly explore, develop, and produce uranium in Wyoming. RTZ Corp. owns 100% of Kennecott, which it acquired in 1989. The 50-million pound Jackpot deposit is included in the venture.
- Denison Mines Ltd.** has sued **Rio Algom Ltd.** for \$35 million in damages, claiming it has lost the ability to mine "significant" ore reserves in its Elliot Lake properties due to inadequate pillar support in Rio Algom's adjacent mine. Denison says it was forced to close its adjacent shafts for safety reasons.
- 13 The **Canadian government** announced it was establishing a **license fee schedule** for nuclear power plants in order to make the Atomic Energy Control Board (AECB) self-supporting. The utility owners of the country's 18 nuclear plants will provide about one-half of the expected C\$28 million in annual license fees.

Nuclear Fuel Industry Developments

(continued)

January

- | | |
|----|--|
| 15 | <p>Nuclear power, at US\$0.062 (9 yen) per kWh, was Japan's cheapest source of electricity in 1989, according to the Ministry of International Trade & Industry.</p> |
| 15 | <p>Czechoslovakia's Energy Minister announced suspension of construction on two nuclear units at Temelin, largely due to pressure from neighboring Austria. Construction will continue on the first two Temelin units, which are expected to be completed in 1992 and 1994.</p> |
| 19 | <p>Rheinisch-Westfälische Elektrizitätswerke AG (RWE) announced its reorganization and new name of RWE AG. RWE AG will act as a holding company for nearly 150 companies arranged under five major subsidiaries: RWE Energie AG (electricity), Rheinbraun AG (mining), RWE-DEA AG (chemical and oil), RWE Entsorgung AG (non-nuclear waste disposal), and Lahmeyer AG (electrical equipment). Nuclear power will fall under RWE Energie, and Rheinbraun AG will control Rheinbraun Australia Pty. Ltd. (a shareholder in the Ranger project) and Uranerz Exploration and Mining, Ltd. Uranit, the German shareholder in Urenco, and Nukem have not yet been assigned to any of the five subsidiaries; neither company is a wholly-owned subsidiary of RWE.</p> |
| 19 | <p>France's Commissariat à l'Énergie Atomique (CEA) proposed the reorganization of its operations, eliminating several management positions and replacing the semi-autonomous Institutes with seven divisions reporting directly to the CEA Administrator. The proposed plan is designed to provide the CEA with more flexibility to respond to future opportunities.</p> |
| 22 | <p>DOE waived for one year the April 1990 notice requirement for FY 2000 deliveries, in an apparent acknowledgement that its customers prefer shorter term contracts in order to maintain their flexibility.</p> |
| 25 | <p>DOE filed suit against the State of Nevada for preventing further site characterization of the final nuclear waste repository.</p> <p>Pakistan's Atomic Energy Commission has abandoned the country's only uranium mine after two employees were killed in local fighting.</p> |

SOVIET URANIUM SUPPLY CAPABILITY

Introduction

Soviet exploration for uranium began in 1946. Before that time only one USSR uranium deposit was known—"the Taboshary"—near Tashkent in the Republic of Uzbekistan. It was explored in 1936 and was the base for an experimental radium plant. Since 1946, a large number of exploration programs have been carried out, resulting in the discovery of numerous uranium deposits, both in the Asian and European parts of the USSR. Current Soviet production planning calls for comprehensive extraction of all valuable minerals from any deposit being exploited, since this offers economic and environmental advantages over selective extraction of only the most valuable components.

Until recently, the Soviet uranium mining industry concentrated on satisfying domestic requirements for nuclear energy and defense programs. International marketing activity was largely limited to the export of enrichment services under long-term contracts to West European countries. However, for the same reasons as the rest of the world, the Soviet Union added nuclear fuel cycle production capacity in anticipation of demand increases that have not taken place. Thus, the USSR has substantial excess capacity available for the production of nuclear fuel materials for export.

The USSR is undertaking a vigorous effort to expand its nuclear fuel trade with countries in Western Europe, North America, and the Far East for the 1990s. Techsnabexport (TSE) handles the marketing and export sales for Soviet

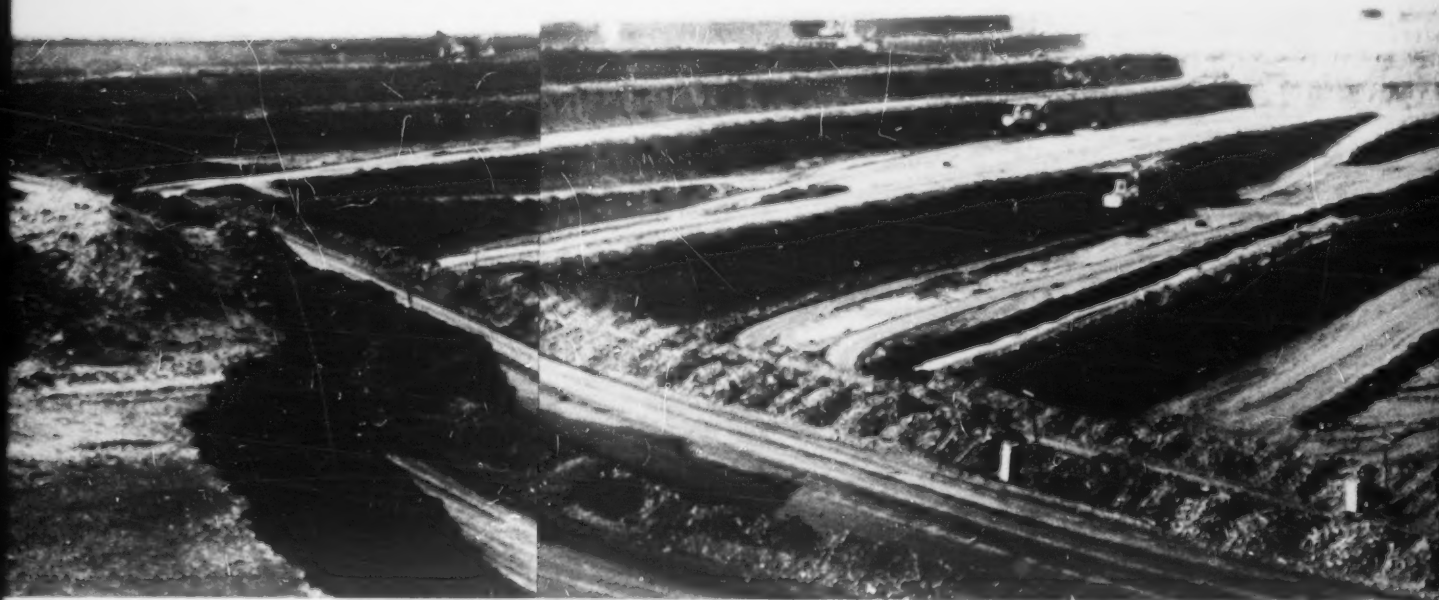


Figure 1. The McLovoe lignite mine on the shore of the Caspian Sea. Note the very high stripping ratio and the

nuclear fuel. TSE is the commercial arm of the USSR Ministry of Atomic Energy and Industry (MAEI) which oversees the Soviet Union's nuclear fuel production industry.

This article describes some of the many active uranium production centers in the Soviet Union. A more comprehensive listing of uranium deposits and processing centers is shown in **Table 1**. Eight processing plants are noted in this article as receiving ore from specific mines or groups of mines; there are at least ten plants in the USSR, including two chemical and metallurgical plants, that produce uranium concentrate. The concentrate is shipped from the milling facilities to any of three conversion plants. The original is at Zholtve Vody in the Ukraine, the second is at Chkalovsk in the southern Ferghana district, and the third is at Kara Belta in northern Kirgiziya. Uranium hexafluoride is transported from the conversion plants to one of two enrichment plants. The main plant is at Zholtve Vody, and another is located at Chkalovsk.

Reserves

Commercially viable uranium deposits (reserves) in the Soviet Union are characterized by great diversity in distribution and type. A number of them have no parallel in other countries. Large deposits have been related to submarine-delta and marine formations, such as the Mangyshlak peninsula (near the city of Shevchenko). Alluvial deposits of ancient riverbeds have been found to contain formations with relatively small uranium reserves.

The most important reserves are found in sandstone (such as the Uchkuduk deposit in Central Asia). Approximately 60 percent of reserves in the Soviet Union are found in sandstone-type deposits and 40 percent are found in vein-type deposits. Identified reserves of uranium are ample for Soviet nuclear energy requirements for more than 100 years (at average rates of development of nuclear energy and if reprocessing is continued).



bucketwheel excavator. This lignite is burned in a nearby power station and the ash is leached to recover uranium.

RAW MATERIALS

Table 1
Soviet Uranium Deposits and Processing Centers

Deposit	Description
<u>European USSR</u>	
1. Sillimae	• Uranium-phosphate rare earth association in clays with detrital fishbones. Uranium mining and milling operations.
2. Zholtse Vody-Terny	• Precambrian uranium-iron ore formation. Irregular stratiform albitized uranium bodies. Uranium in association with conglomerates. Uranium minerals include uraninite, pitchblende, and nenadkevite. Uranium mining and milling.
3. Lermontov	• Uranium-molybdenum associated with volcanic rocks. Mining and milling operations.
4. Chupa District	• Uraniferous pematites in Precambrian gneisses. Uranium mineralization in paleovolcanic and intrusive rocks of Baltic shields.
5. Lake Onega	• Uranium and vanadium mineral in association with black graphitic marine shales, peat, and asphaltite.
<u>Urals</u>	
6. Vishnevogorsk	• Uranium mineralization in nepheline syenite intrusions.
7. Novogornyy	• Uranium mineralization in nepheline syenite.
<u>Kazakhstan and Central Asia</u>	
8. Aksuyek-Kiyakhty	• Uranium mining.
9. Koktas	• Uranium associated with copper mining.
10. Stepnogorsk	• Possible in-situ leaching of deep-seated uranium deposit. Uranium extraction as part of the "Tselinny Mining Complex."
11. Ak-Tyuz-Bordunskiy	• Uranium and rare earths associated with lead mining.
12. Chigirik	• Uranium milling and processing facilities.
13. Granitogorsk	• Uranium possibly associated with lead mining, milling, and concentration center.
14. Min-Kush	• Uranium mining and milling operations associated with lignite.
15. Tyuya-Muyan	• Uranium-vanadium association in metamorphic limestone interlayered with volcanic tuffs and breccia. Tyuyamuyunite, a uranium-vanadium mineral species that was named after this locality.
16. Kyzyl-Dzhar	• Uranium mining associated with gold production.
17. Kadzhi-Say	• Uranium associated with lignite mining.
18. Taboshar	• Uranium vanadium mining. U ₃ O ₈ extraction plant.
19. Chkalovsk	• Uranium extraction and hexafluoride conversion site for Taboshar mine ore.
20. Sumsar	• Possible uranium mining.
21. Uchkuduk	• Uranium associated with gold mining at Kokpatas gold mine. Possible uranium extraction at Navoi Mining and Metallurgical Complex. Ore genetically similar to South African deposits.
22. Naugarzan	• Uranium-fluorite mining. Ore milling at Chigirik.
23. Charkesar	• Site of former uranium mining.
24. Chavlisay-Krasnogorskiy Yangiabad	• Site of uranium mining operation.
25. Kara-Balta	• Uranium processing center.
<u>Siberia</u>	
26. Vikhorevka	• Possible uranium mining of vein-type deposits in ultrametamorphic Archean rocks.
27. Krasnokamensk	• Uranium-fluorspar association in Mesozoic volcanic basins.
28. Slyudyanka	• Pegmatites-uranium and rare earths. Mining reported in 1958 from Precambrian crystalline limestone.
29. Aldan	• Uranium and rare earths associated with gold mining.

Production Methods

Uranium in the Soviet Union is largely recovered through by-product or co-product mining operations, or by in-situ leaching (ISL). For example, **Figure 1** shows a lignite mine at the MeLovoe deposit on the Mangyshlak Peninsula, Kazakhstan.

At present, ISL accounts for 20 percent of uranium concentrate production, but is expected to account for up to 45 percent in coming years due to cost effectiveness and technological improvements. In the USSR, the low overhead and economies of scale resulting from large, efficient mining operations operated by one company tend to keep production costs low, relative to other countries. The recovery of a number of by-products enhances the value extracted from many deposits.

Uranium ores are processed at MAEI's large hydrometallurgical plants. These plants yield a variety of high purity uranium oxides and many useful by-products associated with uranium (molybdenum, rhenium, scandium, vanadium, gold, copper, rare earth elements, and phosphate, mixed and nitrate fertilizers).

Ion-exchange technology forms the basis of commercial methods of extracting uranium and various associated elements from ores, concentrates, and natural and mine waters, and of obtaining high-purity compounds of these elements. The development of durable and efficient ion exchange resins has been a notable achievement of the Soviet mining industry, and their use offers significant cost advantages.

Because of the great diversity of ores processed and the presence of different associated elements, the order of technological processes differs for different plants. Ore preparation methods also differ, different methods are used for dissolution, and the final stages for obtaining the associated elements differ. All the Soviet technologies, however, involve non-filtration adsorption-extraction, which ensures their technological and economic efficiency.

Mines and Mining Districts

Four mining districts have been the major source of the Soviet Union's domestic uranium production. An additional four or five production centers have been less prolific, but their combined output has made important contributions to total uranium supply. **Figure 2** shows some of the reported uranium mining centers in the western and central parts of the Soviet Union.

The first sustained uranium recovery operation began in 1908 at the **Tyuya-Muyun** mine located in the northern Alai Mountains of the Uzbekistan district near the border of China and Afghanistan. Originally, uranium was removed from the mineral concentrates because of the need to purify the other products. More than 900 metric tons of uranium concentrates were recovered as a by-product of copper and vanadium mining during the next seven years. Uranium was recovered almost continuously until the late 1950s. The deposit's average ore grade is about 1.5 percent U_3O_8 .

In the early years of mine life, the relatively high-grade ore averaged almost four percent copper, 2.5 percent vanadium, and approximately one percent uranium. The average grade of mined uranium over the years is not known, but a large ore reserve remains, having an average uranium content of 1.5 percent U_3O_8 , with high-grade zones exceeding four percent. The main uranium mineral is tyuyamunite, a calcium and uranium vanadate, named for the mine site of Tyuya-Muyun hill.

Adjacent mines and others in the northern sector of the **Chatkal/Ferghana region** are currently producing by-product uranium, primarily from fluorspar ores and lignite. A rich mineral trend extends northward from the Tyuya-Muyun mine area to the Ferghana region, continuing northward into the province of **Kazakhstan**, where copper has been mined for many years. Uranium mineralization occurring in association with the copper ore has been recovered as a co-product since the late 1950s. The mineralized complex contains large tonnages of highly disseminated copper and uranium ore, indicating that the mine is likely to be a long-term supplier of uranium.

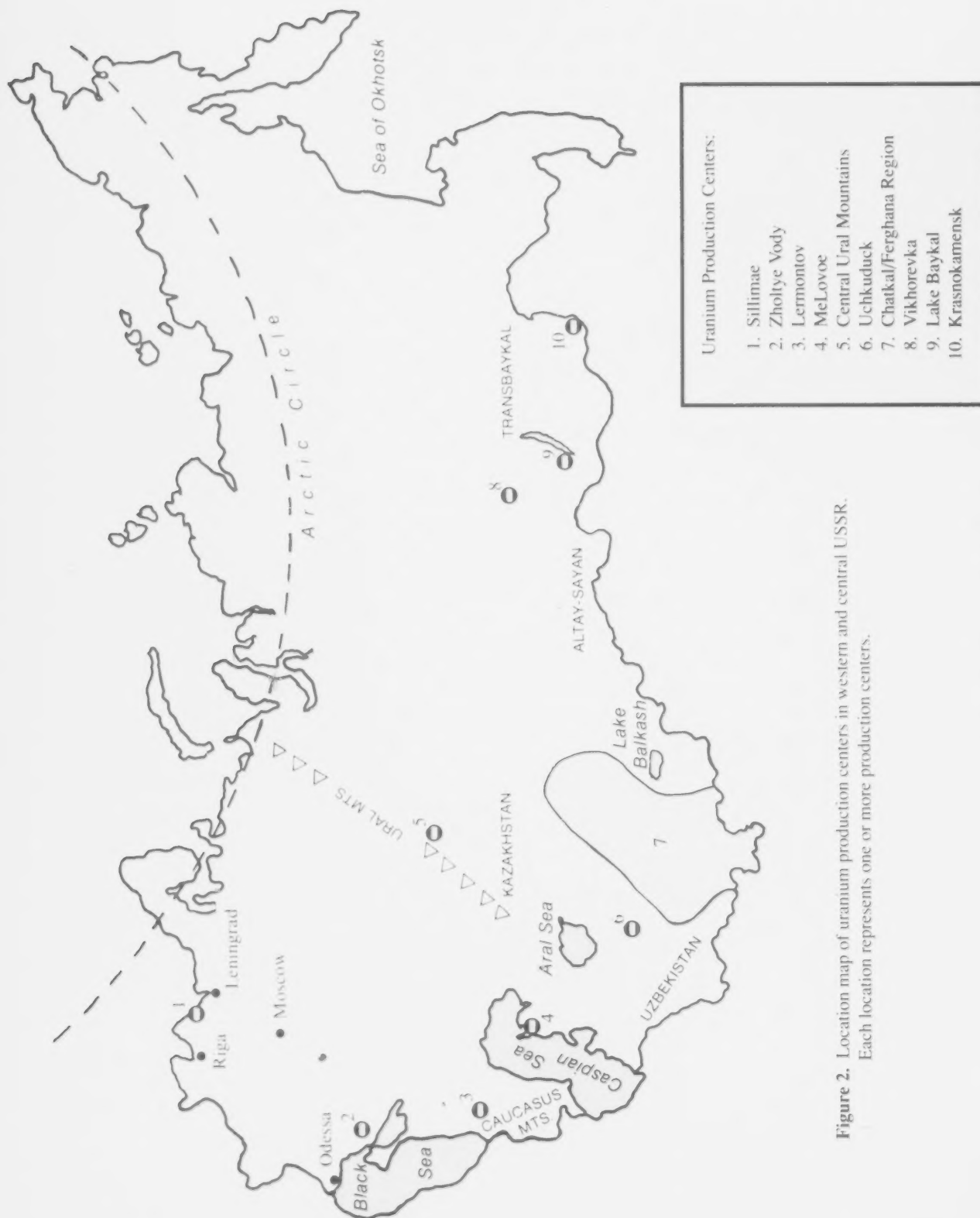


Figure 2. Location map of uranium production centers in western and central USSR.
Each location represents one or more production centers.

RAW MATERIALS

One of the most important production centers lies in the northern sector of the Krivoi Rog iron district in the Dnepropetrovsk Province of the west-central Ukraine. Uranium mining began in the mid-1940s at the **Terny** and **Zholtye Vody** mines, two of the country's first production centers. Uranium originally was the primary product at both mines, but later became a co-product of iron production. Although the Terny mine was closed in 1969, the Zholtye Vody mine continues to produce. (This district is described in Report 194, page 21.)

Molybdenum and uranium are co-produced at mines in several districts, primarily in the western and central parts of the Soviet Union. Uranium from this source is important to the total supply program because of the wide distribution of occurrences and the strategic importance of domestic molybdenum production.

Chatkal/Ferghana District

Most mining in this district has used underground methods. Mines have been developed at strategic locations on the different vein structures. The deepest mines exceed 500 meters in depth, and in some cases are connected by lateral workings. The mined ores are shipped to Chkalovsk via the Great Ferghana Canal for processing. Uranium concentrate is recovered from the ores and is further processed at a nearby conversion plant.

The Chatkal/Ferghana district has 25 to 30 other active mines in which uranium is either the primary mineral recovered or a by-product. The district is the largest source of uranium in the USSR. The mines at **Taboshar** and **Maylisay** produce uranium disseminated in a sandstone formation. Each mine has its own processing plant. The uranium content varies from about 0.10 percent to 0.20 percent U_3O_8 . In the nearby Kara-Tau mountains, uranium is associated with copper and vanadium at the **Bela Sauskandyk** mine. Pitchblende is the dominant uranium mineral present; secondary uranium minerals often are associated with zones of intense hydrothermal alteration.

On the northern flanks of the Kurama mountains are a number of mines from which uranium is recovered as a by-

product of fluorspar, copper, and lignite. The **Naugarzan** mine is the largest fluorspar and uranium mine in the district. Mining began in 1964. The mined ores are shipped directly to a fluorspar mill located at Toytepa; a rough uranium concentrate is separated from the fluorspar and shipped directly to the uranium mill at **Chkalovsk**.

Uranium is recovered as a by-product from lignite burning in at least three different locations. The **Min-Kush** and the **Tsentralnaya** mines are located in the southern portion of the district, the **Almalyk** mine is located about 20 kilometers north of Osh. The latter is the largest mine. It began open-pit production in 1962 and has maintained an annual production level of just over 180,000 metric tons of lignite. The Min-Kush mine is also an open pit, producing about 120,000 metric tons of lignite annually. Initial annual production at the Tsentralnaya mine was about 90,000 metric tons of lignite using underground mining methods. Open-pit mining of the deposit began about 1970, and the annual capacity is well over 100,000 metric tons. The lignite is burned to produce power and the ash from each project is leached at a nearby plant to recover the uranium. The concentrate subsequently is transported to the conversion plant located at Kara-Belta, which has been the main conversion facility for the southern district since the early 1950s.

In the central part of the district, uranium is recovered as a by-product from lead ore mined at the **Bordunskiy**, **Ak-Tyuz**, and **Orlovka** mines. The uranium is recovered at the Kirgiziya metallurgical complex located near Orlovka, probably using flotation techniques. Finally, uranium is recovered as a co-product from gold ores produced at several mines situated in the **Kyzyl Dzhar** mining district. It is likely that the gold ores are processed at the Kirgiziya complex, and the uranium is separated from the ore by flotation. Also, the uranium concentrate is probably leached and precipitated as ammonium diuranate (ADU).

The northern sector of the Chatkal/Ferghana district has only recently developed into an important uranium-producing area. In the southern Kazakhstan republic, an extensive mineralized trend has been discovered to contain a variety of minerals. Most important are the vast reserves

RAW MATERIALS

of porphyry-type copper mineralization disseminated throughout metamorphic and igneous rock hosts, much of which is known to contain significant quantities of uranium. Open-pit and underground primary copper mines have been developed along the trend. Uranium is a co-product in at least five of the mines. The largest uranium production center may be the Stepnogorsk underground mine located northeast of Tselinograd. Uranium and copper occur in a vein system containing considerably higher grade than the disseminated ores.

Other uranium mines include the **Koktas, Kiyakhty, Aksuyek,** and **Akhabay** mines located to the south near Lake Balkash. Each is an open-pit mine where low-grade uranium is mined as a co-product of copper. The rough uranium concentrate from those mines is collected for shipment to the Tseliny Mining and Chemical Complex near Stepnogorsk. Uranium concentrate is shipped elsewhere for further processing.

Other Uranium Districts

Molybdenum-uranium deposits are found in a variety of geologic settings. Most occur in association with hydrothermal mineralization related to sedimentary deposition in close proximity to volcanic and intrusive rocks of Paleozoic age. Primary mineralization is disseminated in the volcanics and intrusives. Diorite dikes and volcanic pipes and plugs are frequently mineralized. The mineral suite may contain uranium and sulfide minerals such as molybdenite, galena, and pyrite. Higher-grade ores often are found near intrusive contact zones and in sediments. Zone of contact metamorphism, especially in sediments (sandstones and conglomerates) are highly favorable for ore accumulation.

Pitchblende is the main uranium mineral present, forming low-grade ore where disseminated, and often increasing in percentage at the contact zone and within the sediments. The most important deposits are situated where rock structure has been influenced by hydrothermal activity

adjacent to fault and fracture zones. The mineralization is confined to vein systems, veinlets, and in stockworks where intense alteration has taken place.

Low-grade molybdenum-uranium occurrences have been discovered in Proterozoic rocks of the Siberian and Aldan shield regions. The mineral accumulation probably is the result of precipitation from hydrothermal solutions invading intensely fractured rock. Titanium and iron are common mineral constituents in the more complex occurrences.

Uranium is recovered as a by-product of phosphoric acid production at **Sillimae** near the Baltic Sea coast in Estonia. It is the largest phosphate-uranium operation in the USSR. Uranium is contained primarily in fish bone detritus common to the phosphate deposit. The uranium values are low, in a range of approximately 40 to 90 parts per million in the phosphate-bearing rock. However, the demonstrated association between uranium and the detritus material suggests that higher uranium values are likely to occur where the detritus has accumulated as a result of depositional changes.

The recovery of uranium from the phosphate begins with the acidulation of the phosphate rock. In this wet process, the phosphate is completely digested by sulfuric acid. Under ideal conditions, approximately 90 percent of the contained uranium is stripped from the acid stream through the application of basic solvent extraction technology. Large quantities of phosphatic fertilizer and uranium are manufactured annually and vast ore reserves assure the project's longevity.

Uranium also is recovered from the waste water generated during the refining process of petroleum products from the Ukhta oilfields located in the Pechora Basin, in the northern part of Western USSR. Uranium and radium metals contained in the oil are taken into solution and remain there through the final stage of refinery use. The metals are recovered by precipitation from the process water. Oil production amounts to millions of barrels annually, suggesting that uranium recovery from this project is high.

Conclusion

For many years, only limited information concerning uranium deposits in the USSR has been available from Soviet sources. The Soviet Union has, however, cooperated in some past efforts to promote interaction with the international scientific community. For example, in 1984 the Soviet Union hosted the 27th International Geological Congress (IGC). The uranium portion included 50 papers, primarily on uranium deposits in sandstone and metamorphic rocks, presented to about 300 members.

The IGC sponsored almost 400 geology field trips, the most noteworthy of which was a five-day trip to the Krivoi Rog iron and uranium district in the south-central Ukraine, including visits to two open-pit iron mines and the

underground Novaya uranium mine in Zholtve Vody. That conference was reported in detail in the October 1984 NUEXCO Monthly Report (No. 194, pp. 21-24). Some other information that has been made available over the years is contained in the April 1985 Report (No. 200, pp. 21-25) discussion of uranium deposit classifications.

Advanced processing technology, low-cost labor, by-product and co-product recovery, and the large existing production capacity enable MAEI to produce nuclear fuel at low cost. The Soviet Union's reserve base, technological development, and production experience make it one of the world's leading producers of nuclear fuel. As additional information is made available for publication, NUEXCO will present updated reports on the nuclear fuel cycle facilities in the Soviet Union. ■

RAW MATERIALS

REPUBLIC OF SOUTH AFRICA

Fourth Quarter 1989 Production

South Africa's uranium producers continue to be plagued by increased costs and falling uranium prices, in addition to markets diminished as a result of political pressures. Working cost increases came from the doubling of gold production costs in the last five years, due to lower gold ore grades and greater working depths. These increased costs have further hampered South Africa uranium producers' ability to compete in the current uranium market. After a modest loss of 2.4 percent in production volume in 1988, 1989 production tumbled an additional 23.5 percent, from 9.7 million pounds U₃O₈ in 1988, down to 7.4 million pounds in 1989.

Only one mine—Western Areas—managed to increase uranium output between 1988 and 1989. Production decreases for the other five members of the Chamber-of Mines ranged from three percent to ten percent. Vaal Reefs, the largest South African uranium producer, showed a 5.4 percent decline from the previous year, but still produced more than half of South Africa's total uranium output in 1989.

These difficult economic conditions have reduced the number of operating mines to seven (including Palabora), where twelve were operating just three years ago. ■

Table 1
REPUBLIC OF SOUTH AFRICA
RECENT URANIUM PRODUCTION¹
(Thousands of Pounds U₃O₈)

Operation	First Quarter 1989	Second Quarter 1989	Third Quarter 1989	Fourth Quarter 1989	TOTAL 1989	Percent Change ²
Buffelsfontein	231	216	221	187	855	-15.4
ERGO ³	109	105	80	87	382	+8.8
Freegold ⁴	256	224	262	236	978	-9.9
Hartebeestfontein	199	182	183	195	759	+6.6
Vaal Reefs	962	941	1,011	1,021	3,935	+1.0
Western Areas	117	112	131	136	496	+3.8
TOTAL⁵	1,874	1,780	1,888	1,863	7,404	-1.3

¹ Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.

² Change in percent from the third quarter of 1989.

³ ERGO = East Rand Gold and Uranium Company Ltd.

⁴ Formerly Free State Joint Metallurgical Scheme.

⁵ Columns may not add up due to rounding.

PROJECTED URANIUM REQUIREMENTS OF DEVELOPING COUNTRIES

The following is an edited version of the paper presented by Treva E. King of NUEXCO Information Services before the Uranium Institute's Supply/Demand Committee in London, England, on January 19, 1990.

Introduction

The objective of this paper is to examine the uranium requirements of developing countries both in aggregate and individually. Although the cumulative uranium requirements of these countries are expected to account for less than eight percent of total requirements, the fact that many of these countries are expressing renewed interest in nuclear is, in itself, encouraging. The countries analyzed in this paper are Argentina, Brazil, Egypt, India, Israel, Mexico, Pakistan, South Africa, South Korea and Taiwan.

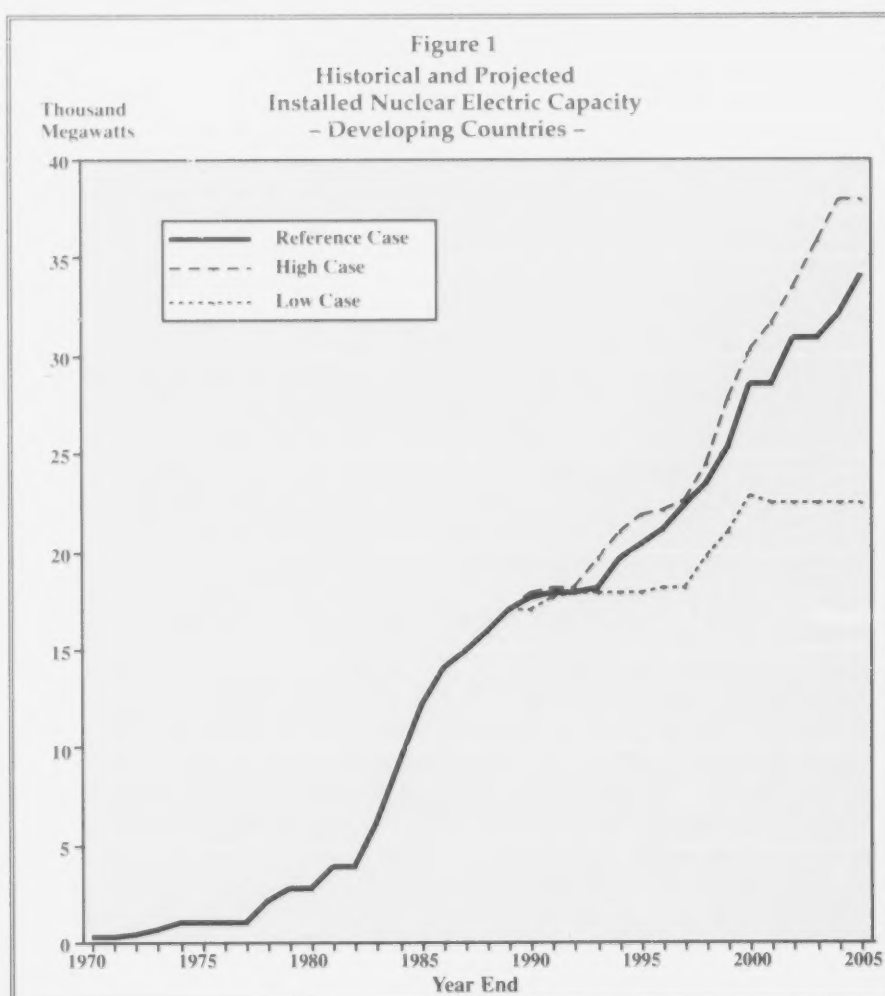
For each country, the existing and planned nuclear capacity levels have been identified and capacity factors have been projected. For countries with no previous nuclear power, the world weighted average capacity factor for the specific reactor type is utilized. Other factors influencing nuclear power demand and operations of these developing countries will be discussed, and finally, uranium requirements based on a calculated optimal tails assay of .30 will be provided.

Nuclear Electric Capacity

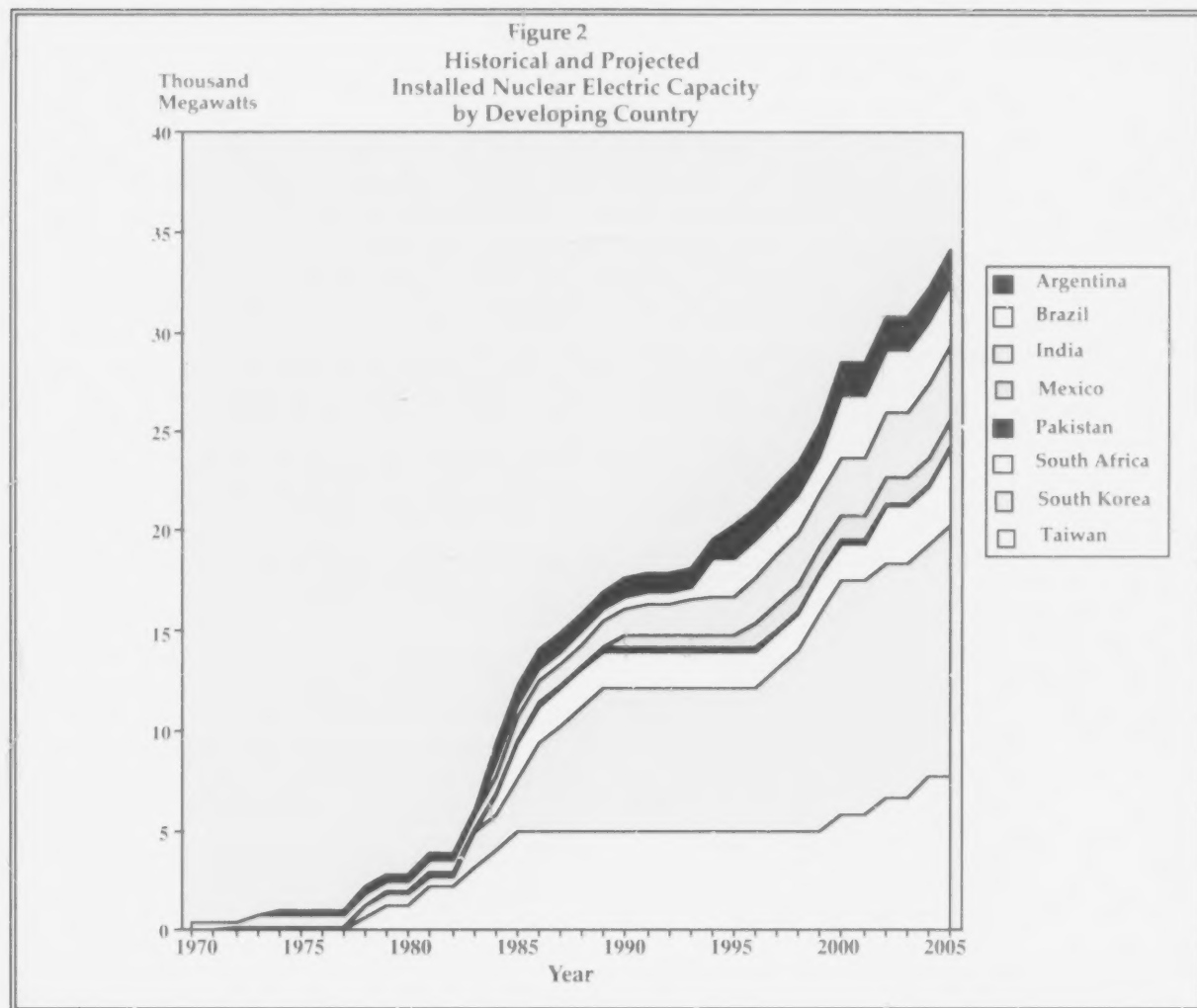
Three projection cases for installed nuclear electric capacity are developed incorporating varying degrees of optimism/pessimism regarding completion dates of reactors under construction, cancellation of partially constructed reactors, and the construction start and completion dates of planned and unplanned future reactors.

The reference growth case assumes some slippage from announced schedules of reactors under construction and

Figure 1
Historical and Projected
Installed Nuclear Electric Capacity
- Developing Countries -



ANALYSIS AND COMMENTARY



most reactors whose construction is presently halted are assumed to be cancelled. The low growth case assumes more slippage and that all reactors with halted construction programs are cancelled. The high growth case assumes reactors under construction will be completed as scheduled and that most halted reactors will eventually be completed.

Figure 1 shows the three projection cases of historical and projected installed nuclear capacity for the developing countries. Nuclear growth is expected to proceed rapidly in the developing countries, increasing 65 percent from 1989 to 2000 in the reference case.

Figure 2 shows the installed nuclear electric capacity by country in the form of a stacked area chart. As of 1989,

South Korea and Taiwan represent about 70 percent of the total capacity, however, their share declines to just over 57 percent by 2000, as Argentina, Brazil, India and Mexico shares increase.

Information on projected electric capacity by reactor type for the key years of 1989, 2000, and 2005, is shown in **Figure 3**. Although the PWR predominates, the heavy water reactor is favored by several developing countries because it does not require enriched uranium, which can be difficult for a developing country to obtain due to safeguards considerations.

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Table 1
Historical Plant Capacity Factors
—Developing Countries—

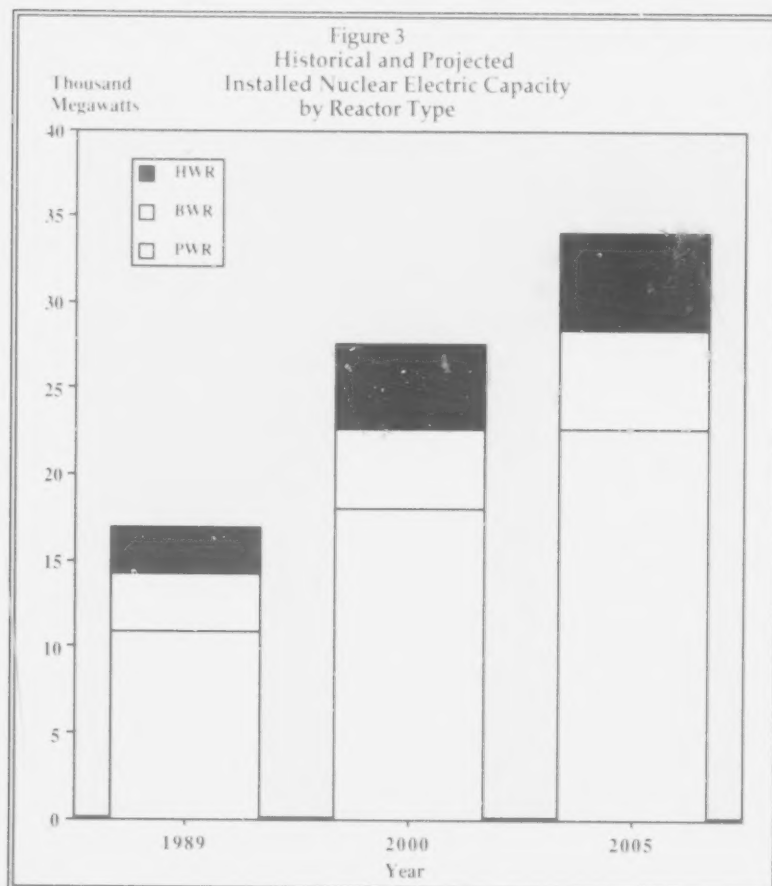
Year	Capacity Factor
1979	58.3
1980	64.1
1981	65.3
1982	53.6
1983	61.1
1984	67.5
1985	63.5
1986	58.1
1987	66.1
1988	65.2

Capacity Factors

Historical plant capacity factors for the developing countries are shown in **Table 1**. They ranged from a low of 53.6 percent to a high of 67.5 percent in 1984. The mean was 62.3 percent for the period shown. To determine future capacity factors, individual reactor data was processed to yield a capacity-weighted average capacity factor for each reactor type in each country for three years (1986, 1987, 1988). These averaged values were used as the capacity factors in 1989 for that reactor type in that country.

In order to allow for reasonable future improvements in plant operating reliability, it is assumed that an increase of 25 percent of the difference between an assumed theoretically "perfect" capacity factor and the 1989 capacity factor will be achieved. This methodology yields small additional capacity factor improvement for countries/reactor types presently experiencing high capacity factor values and a larger improvement for those currently experiencing low capacity factors. No further improvement is assumed after 2000. For countries with no previous nuclear power, the world weighted average capacity factor for that reactor type is utilized.

Figure 3
Historical and Projected
Installed Nuclear Electric Capacity
by Reactor Type



Country Summaries

The countries analyzed in this paper are now discussed individually. **Table 2** provides a list of reactors, both operating and under construction, for each country.

Argentina

Two nuclear power plants are in commercial operation. Atucha 1, a 335-MWe HWR supplied by KWU was down for repairs for 17 months until January 1990. Embalse, a 600-MWe CANDU HWR is currently in operation, however, it has recently suffered operational problems. During the past three years, these reactors have operated at an average capacity factor of 66

ANALYSIS AND COMMENTARY

Table 2
Reactors Operating and Under Construction in Developing Countries

Country	Reactor	Type	MWe Net	Percent Complete ¹	Commercial Operation Date
Argentina	Atucha 1	HWR	335	100	1974
	Atucha 2	HWR	692	64	1995
	Embalse	HWR	600	100	1984
Brazil	Angra 1	PWR	626	100	1984
	Angra 2	PWR	1245	69	1994
	Angra 3	PWR	1245	28	2000
Egypt	El Dabaa 1	PWR	900	0	1999
	El Dabaa 2	PWR	900	0	2003
India	Kaiga 1	HWR	220	18	1996
	Kaiga 2	HWR	220	18	1997
	Kakrapar 1	HWR	220	57	1993
	Kakrapar 2	HWR	220	44	1994
	Kalpakkam 1	HWR	215	100	1984
	Kalpakkam 2	HWR	215	100	1985
	Narora 1	HWR	220	100	1989
	Narora 2	HWR	220	85	1991
	Rajasthan 1	HWR	204	100	1973
	Rajasthan 2	HWR	184	100	1981
	Rajasthan 3	HWR	220	10	1998
	Rajasthan 4	HWR	220	10	2000
	Tarapur 1	BWR	160	100	1969
	Tarapur 2	BWR	160	100	1969
Israel	Shivta 1	PWR	900	0	2002
Mexico	Laguna Verde 1	BWR	654	100	1989
	Laguna Verde 2	BWR	654	53	1996
Pakistan	Kanupp	HWR	137	100	1972
South Africa	Koeberg 1	PWR	920	100	1984
	Koeberg 2	PWR	920	100	1985
South Korea	Kori 1	PWR	556	100	1978
	Kori 2	PWR	605	100	1983
	Kori 3	PWR	895	100	1985
	Kori 4	PWR	895	100	1986
	Uljin 1	PWR	943	100	1988
	Uljin 2	PWR	943	100	1989
	Wolsung	HWR	629	100	1983
	Yongkwang 1	PWR	900	100	1986
	Yongkwang 2	PWR	900	100	1987
Taiwan	Chinshan 1	BWR	604	100	1978
	Chinshan 2	BWR	604	100	1979
	Kuosheng 1	BWR	948	100	1981
	Kuosheng 2	BWR	948	100	1983
	Maanshan 1	PWR	890	100	1984
	Maanshan 2	PWR	890	100	1985

¹ Data on units under construction as of June 30, 1989. Source: Nuclear News

ANALYSIS AND COMMENTARY

percent, and provided 7.8 percent of Argentina's electric generating capacity in 1988. Atucha 2 is under construction, about 64 percent complete, and is projected for operation in 1995.

Argentina continues to pursue nuclear power, with the avid support of its recently elected President, Carlos Menem. Additional nuclear capacity would help reduce the severe electricity shortages the country has been experiencing. However, several issues must be addressed before Argentina can actively participate in nuclear energy. The country must sign the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) or another safeguards agreement, and it needs to resolve continuing national debt repayment problems, which are major obstacles to the financing of new reactors. This last problem can be partially offset by Argentina's continued active involvement in the export of research reactors.

Brazil

Angra 1, a 626-MWe PWR, is Brazil's only operating nuclear plant. It resumed operation in October 1988, following a 16-month outage for repairs and modifications, and entered its second refueling outage October 1, 1989. A municipal court order obtained by members of Brazil's Green Party had prevented the reactor from restarting, but an appeal, based upon a favorable review from a recent IAEA Operational Safety Review Team, was successful, and Angra 1 was restarted in January 1990.

Angra 2 and 3, both 1245-MWe PWRs, are under construction and scheduled for completion in the 1990s. There is some doubt as to whether construction will continue on the Angra 3 unit. Progress of nuclear power in the country has diminished due to slow growth in electricity demand, hyperinflation, and excessive foreign debt. Nuclear power made up only 0.3 percent of Brazil's 1988 electric generating capacity.

Brazil has also reorganized its nuclear industry by transferring responsibility for construction and engineering of nuclear power plants to the utilities. The government's role will be restricted to dealing with policy and regulatory issues.

Egypt

Two 900-MWe PWR reactors are expected to begin commercial operation in 1999 and 2003 at El Dabaa. However, negotiations have stalled on the proposed El Dabaa projects. Although bids were solicited for supply

of the reactors, a supplier has not been selected. Egypt is reportedly considering a long-term energy strategy in which nuclear power plays a major role.

India

India has an aggressive nuclear power program in progress. Seven nuclear units are in operation and another seven are under construction. All of these are HWRs and are not dependent on enriched uranium. India completed negotiations with the USSR for the construction and financing by the USSR of two large PWR units, to be located in Kudankulam in Tamil Nadu state. Plans are also underway to construct two HWR units at Tarapur, and possibly four more HWR units at Rawatbhata in Rajasthan state.

Narora 1 achieved criticality in March 1989 and was operating commercially by the end of 1989. India's nuclear generating capacity is projected to grow rapidly in the next decade, despite the fact India has still not signed the NPT. India's reactors averaged a 48-percent capacity factor over the past three years, and made up three percent of India's 1988 electric generating capacity.

Israel

Shivta 1, a 900-MWe PWR is currently scheduled to begin commercial operation in 2002. Israel has expressed interest to several suppliers (AECL and Framatome) for the supply of the nuclear reactor. Their success may be limited unless they agree to sign the NPT.

Mexico

Mexico's first nuclear plant, Laguna Verde 1, a 654-MWe BWR, achieved first criticality near the end of 1988 and began commercial operation in 1989. Laguna Verde 2 is expected to begin operation in 1996.

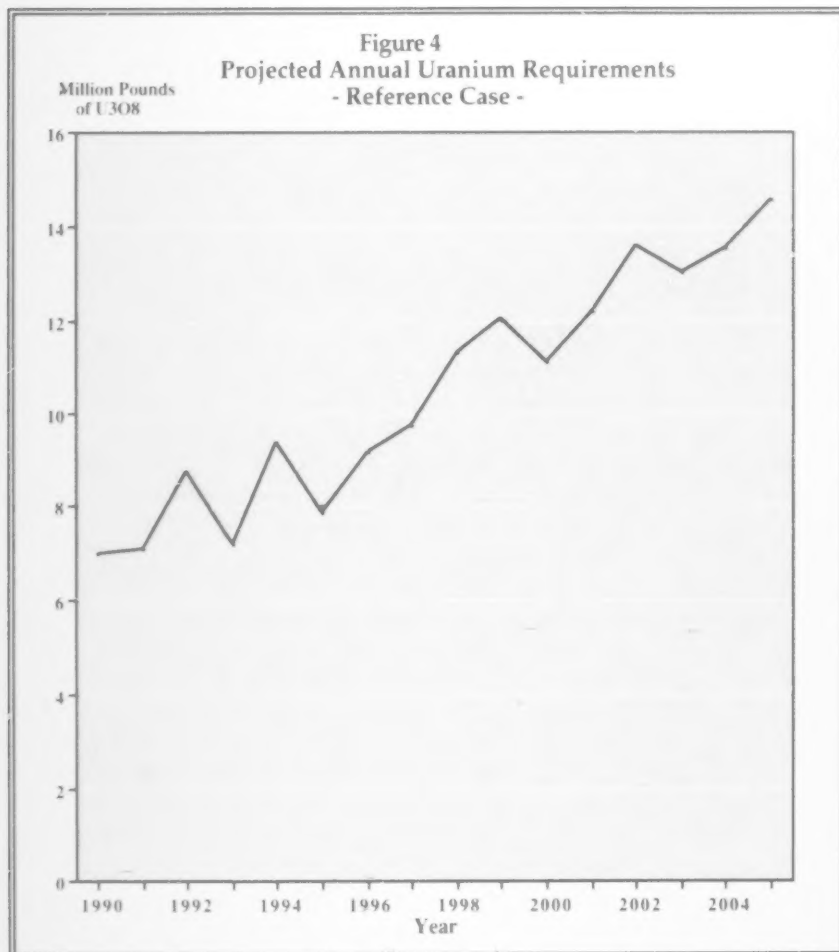
Pakistan

Pakistan's Kanupp reactor, a 137-MWe HWR, has experienced a substantial decline in its capacity factor over the past few years. The plant was closed for several months due to a leak of heavy water in April 1989. The three-year average of 27.9 percent is expected to gradually increase to about 43 percent by 2000.

South Africa

The two-unit Koeberg PWR built by Framatome, supplied 7.3 percent of South Africa's electric generating capacity

ANALYSIS AND COMMENTARY



and reached a capacity factor of 65 percent in 1988. The station capacity factor during the last three years averaged 53 percent. Construction of additional nuclear generating capacity is currently being considered.

South Korea

Currently South Korea has eight PWRs and one HWR in operation totalling over 7,000 megawatts. The Uljin 1 unit, a 943-MWe PWR operating since 1988, was brought down for planned maintenance in October 1989. Uljin 2 began commercial generation September 30, 1989, but was taken off-line in November after experiencing operational problems. The Korean PWR's averaged a 75-percent capacity factor over the past three years, and the HWR averaged 84 percent. Nuclear power contributed

46.9 percent of South Korea's electric generating capacity in 1988. However, it will be the late 1990's before any additional units enter service.

Taiwan

Taiwan's last nuclear unit entered service in 1985. Six units are presently in operation, with an installed nuclear capacity of 4,900 MWe. These units constitute about 30 percent of Taiwan's electric generating capacity, but generate about 50 percent of the total electricity production due to their base load operation. Taiwan's reactors averaged a 68-percent capacity factor over the past three years.

Taiwan's nuclear program has been beset with uncertainty and indecision since 1985 when the Ministry of Economic Affairs suspended plans for a seventh and eighth reactor. In the meantime, coal fueled units are under construction. The government and Taipower are attempting to restore public confidence in and to promote public understanding of nuclear power through extensive

public relations. In 1988, the Atomic Energy Council of Taiwan invited an international panel of nuclear safety experts to review nuclear safety practices at Taipower plants. The panel praised Taiwan's nuclear program as well as Taipower's safety record, but indicated that in some respects the performance could be improved.

Uranium Requirements

Based on the reference growth case for nuclear capacity, the aggregate uranium requirements for developing countries show substantial growth in the late 1990s and early 2000. **Figure 4** indicates an increase of over 100 percent from 1990 to 2005, which represents approximately a seven-percent average annual growth rate.

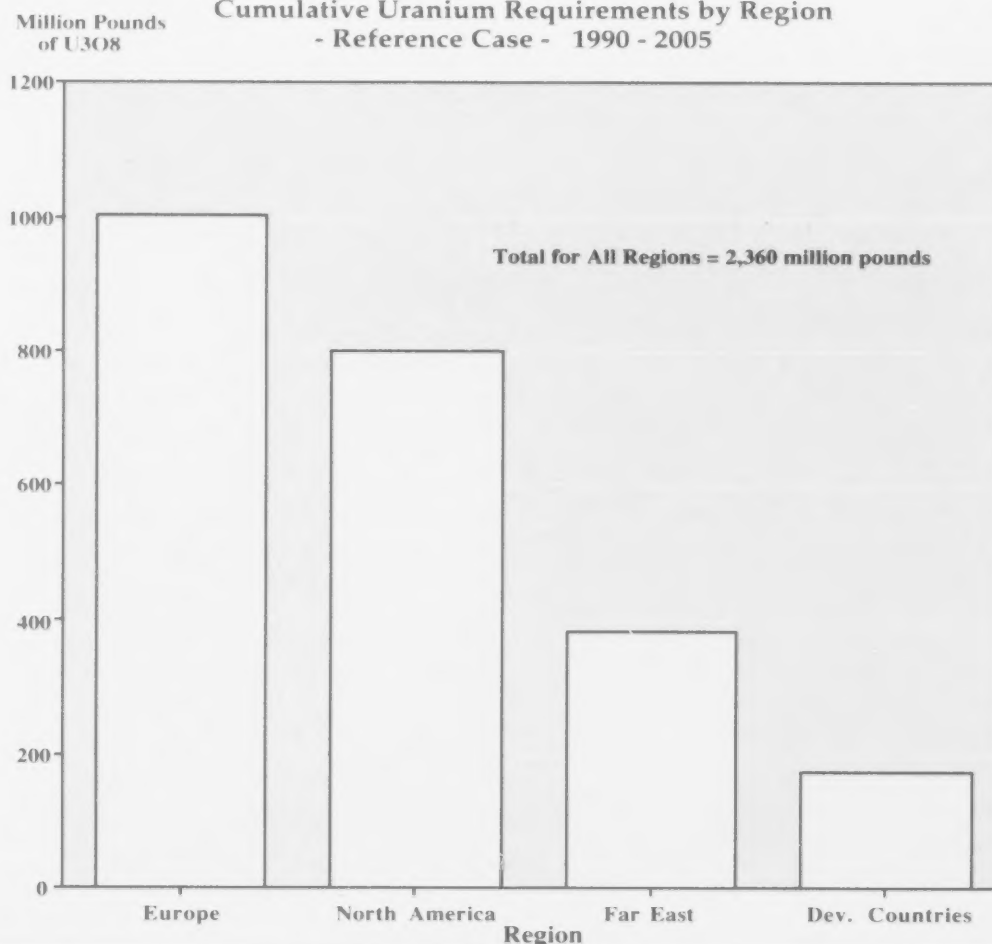
ANALYSIS AND COMMENTARY

Cumulative uranium requirements by country for 1990 through 2005 are shown in **Table 3**. South Korea and Taiwan are expected to have the most significant uranium requirements, averaging about 7.5 million pounds annually. It should be noted that the cumulative requirements include needs for operating reactors and reactors under construction, as well as any known planned and future reactors. Although these developing countries are planning substantial additions of nuclear power, resulting in increased uranium requirements, their effect on world uranium requirements is minimal. **Figure 5** provides a look at the cumulative uranium requirements by region.

Table 3
Cumulative Uranium Requirements
by Country 1990 - 2005

Country	Thousand lbs U ₃ O ₈
Argentina	8,235
Brazil	7,739
India	13,107
Mexico	7,005
Pakistan	425
South Africa	14,988
South Korea	73,271
Taiwan	42,877

Figure 5
Cumulative Uranium Requirements by Region
- Reference Case - 1990 - 2005



CALENDAR

Nuclear Industry Calendar

1990

- | | |
|--------------------|---|
| Feb. 25 -
Mar 1 | Waste Management '90 (Tucson, Arizona), sponsored by the University of Arizona, Department of Nuclear Energy Engineering and Mines, Tucson, AZ 85721. |
| Mar. 4-8 | 7th Pacific Basin Conference (Sheraton Harbor Island Hotel, San Diego, California), sponsored by the ANS. Contact the ANS Meetings Department at 1-312-352-6611. |
| Mar. 12-15 | Radioactive Material Transportation Basic Workshop (Oak Ridge, Tennessee). Contact Teresa Yearwood at 1-615-482-9031. |
| Mar. 25-28 | Fuel Cycle '90 Conference (Opryland Hotel, Nashville, Tennessee), sponsored by the US Council for Energy Awareness. Contact the USCEA Conference Office at 1-202-293-0770. |
| Apr. 8-12 | First Annual International High-Level Radioactive Waste Management Conference (Caesar's Palace Hotel, Las Vegas, Nevada), sponsored by the American Nuclear Society and American Society of Civil Engineers. Contact the ANS at Meetings Department at 1-312-352-6611. |
| Apr. 9-11 | 23rd JAIF Annual Conference (Kyoto, Japan). Contact Ms. Sachie Sugoh, Dept. of Planning and International Affairs, JAIF, at 03-508-9056. |
| Apr. 22-25 | INFO '90 (Westin Hotel, Dallas, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770. |
| Apr. 23-27 | 1st Regional Seminar for the Middle East and Europe on Management of Quality for Nuclear Power Projects (Prague, Czechoslovakia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400, Vienna, Austria. |
| May 15-17 | Annual Meeting on Nuclear Technology 90 (Nuremburg, FR Germany). Contact Deutsches Atomforum e.V., Conference Office JK 90 at 0228 507223. |
| June 3-7 | 30th Annual Conference of the Canadian Nuclear Association and 11th Annual Conference of the Canadian Nuclear Society (Toronto, Canada). Contact Canadian Nuclear Association, 111 Elizabeth Street, Toronto, Ontario, Canada M5G 1P7. |
| June 4-8 | International Symposium on Nuclear Techniques in Exploration and Exploitation of Energy and Mineral Resources (Moscow, USSR). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria. |
| Sept. 4-7 | International Seminar on the Costs and Financing of Nuclear Power in Developing Countries (Jakarta, Indonesia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria. |

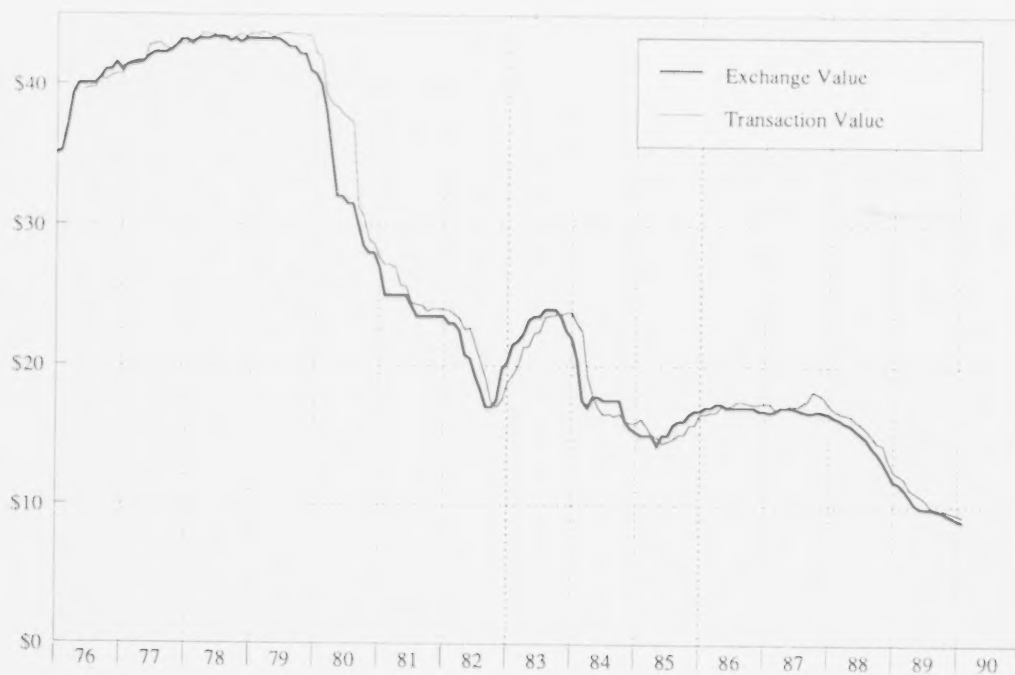
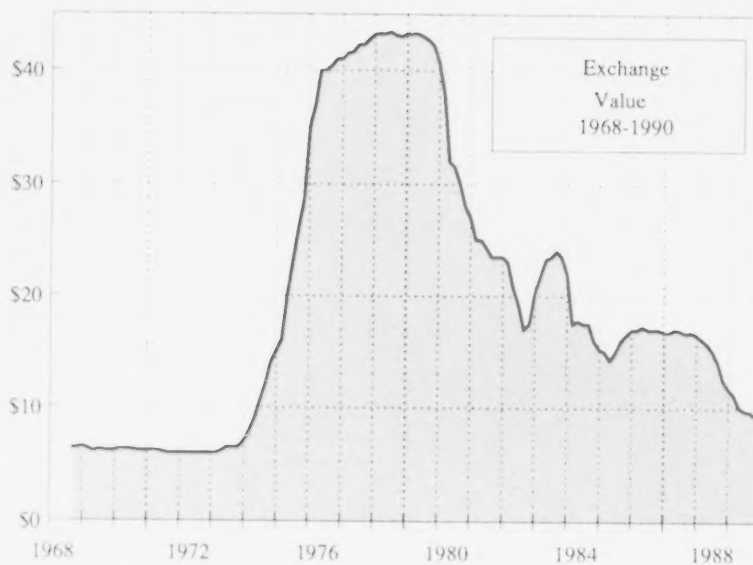
**Nuclear Industry Calendar
(continued)****1990**

- Sept. 5-7** *Uranium Institute 15th Annual Symposium* (London, United Kingdom). Contact the UI at 44-1-225-0308.
- Sept. 16-19** *Uranium Seminar '90* (Hyatt Regency, San Antonio, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.
- Nov. 11-14** *Nuclear Energy Forum* (Washington Hilton, Washington, D.C.), sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611.

HISTORICAL MARKET DATA

**NUEXCO Historical
Exchange and
Transaction Values**

(In US Dollars/Pound U.S.)



HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (\$US/lb U₃O₈)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85											

HISTORICAL US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated (\$US/lb U₃O₈)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	None	

HISTORICAL MARKET DATA

HISTORICAL UF₆ VALUES Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90											

HISTORICAL US UF₆ PREMIUM (Relative to the UF₆ Value) Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	None	

HISTORICAL TRANSACTION VALUES Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25											

HISTORICAL MARKET DATA
HISTORICAL LOAN RATES

Determined as of the last day of the month indicated (Percent/Annum)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50											

* Float with Prime Rate

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (\$US/lb U as UF6)

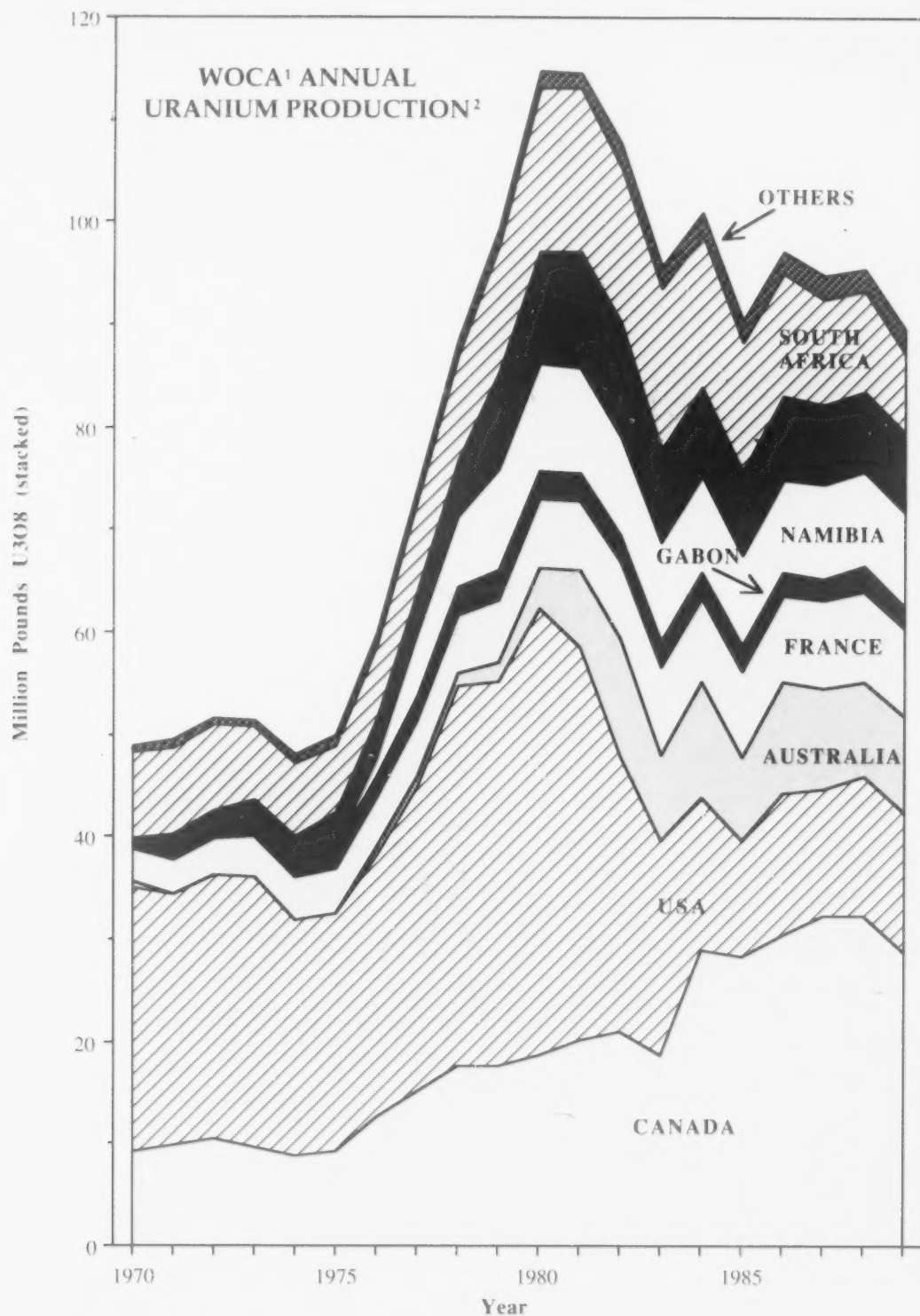
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.65											

HISTORICAL SWU VALUES

Determined as of the last day of the month indicated (\$US/SWU)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54											

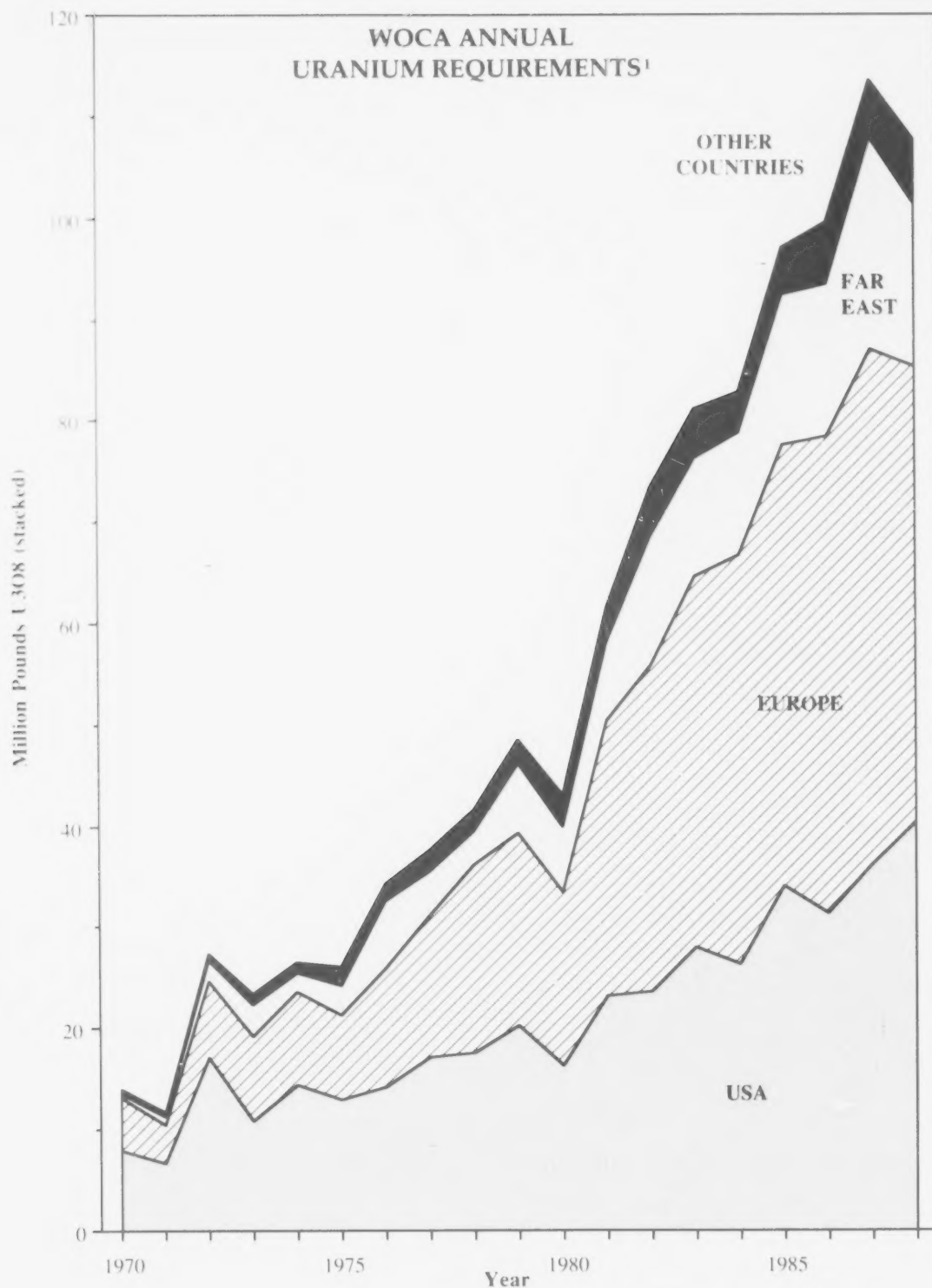
HISTORICAL MARKET DATA



¹ WOCA = World Outside of Centrally-Planned Economic Areas.

² Estimated world production in 1989 totalled 89.6 million pounds (Australia—9.5; Canada—28.7; France—8.5; Gabon—2.2; Namibia—9.2; Niger—7.7; South Africa—7.7; USA—13.7; Other—2.3).

HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual plant completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

HISTORICAL MARKET DATA

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	16.10	3.6	n/a	1.2
1977	29.9	27.8	19.75	5.6	n/a	4.0
1978	37.0	31.6	21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agents

³ Includes imports by domestic utilities and domestic suppliers

HISTORICAL MARKET DATA

VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY¹ (Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC ² (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ^{3,4}		Spot Contracts ^{3,4}	
			Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈	Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,500	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65R	\$16.13R

R = Revised

¹The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

²The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in several different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

⁴Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

GOVERNMENT STATISTICS

AUSTRALIA					
		Consumer Price Index ¹ (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ² (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia (Australian dollars) ⁶	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates ³ (June 1985=100)
1980	Avg.	95.8	83.1	—	140.8 ^s
1981	Avg.	105.0	85.9	—	154.1 ^s
1982	Avg.	116.7	89.0	—	174.9 ^s
1983	Avg.	128.5	96.9	—	181.9 ^s
1984	Avg.	133.6	98.0	—	194.4 ^s
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
Jan	1989	—	110.6	—	122.2
Feb	1989	—	111.2	521.90	122.2
Mar	1989	188.1R	114.9	—	123.1
Apr	1989	—	117.5	—	123.2
May	1989	—	118.6	530.40R	123.7
June	1989	192.8	119.9	—	124.7R
July	1989	—	120.1	—	125.8R
Aug	1989	—	119.2	539.30	125.9R
Sept	1989	197.2	117.7	—	125.9R
Oct	1989	—	117.8	—	126.0
Nov	1989	—	118.0	—	126.2

P = Preliminary R = Revised since last month

¹Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

²Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

³Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

⁴Monthly data for the period 1967 to 1986 appear in Report 233.

⁵Base: June 1976 = 100.

⁶Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

GOVERNMENT STATISTICS

CANADA

Wage-earner Data:
Average Hourly Earnings (C\$)²

		Industrial Products Price Index: All Commodities ¹ (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells ³ (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	138.2	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	143.8	20.91	18.51	16.95	13.17	13.77
Jan	1989	130.7	146.8	21.22	19.45	18.14	13.75	13.82
Feb	1989	130.8	147.8	22.05	19.51	18.26	13.79	13.89
Mar	1989	131.3	148.5	21.90	19.65	18.35	13.62	14.10
Apr	1989	131.3	149.0	22.37	19.80	18.40	13.57	14.16
May	1989	131.4	150.5	21.89	20.02	18.17	13.76	14.27
June	1989	131.5R	151.3	21.89	20.02	18.17	13.76	13.22
July	1989	131.4R	152.3	21.67	19.60	17.96	13.57	12.98
Aug	1989	131.3R	152.4	20.97	19.76	18.24	13.52	14.30
Sept	1989	131.0R	152.6	21.97	20.61	18.73	13.68	14.83
Oct	1989	130.8	153.2	22.26	20.71R	18.74R	13.99	14.77R
Nov	1989	130.6R	153.7	22.60P	20.52P	18.80P	13.93P	14.65P
Dec	1989	130.2	153.6	—	—	—	—	—

P = Preliminary R = Revised since last month

¹Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

²Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

³Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA							
		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand) ¹	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100) ²	Consumer Price Index ³ (1985 = 100)	Production Price Index All Groups ⁴ (1985 = 100)	Total Employment in Mining and Quarrying ⁵	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) ⁵
1980	Avg.	35.53	—	51.9	55.2R	709,042	2,237,689
1981	Avg.	41.89	—	59.8	62.7R	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	71.4R	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	79.0R	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	85.6R	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	100.0R	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	119.5R	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	136.2R	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	154.1R	705,355	7,774,054
Jan	1989	—	—	166.8	165.5R	714,593	704,320
Feb	1989	—	—	168.2	168.5R	696,329	669,983
Mar	1989	112.29	262.8	170.9	171.1R	702,746	695,843
Apr	1989	—	—	173.1	173.8R	658,677	634,344
May	1989	—	—	175.9	176.4R	706,056	721,263
June	1989	113.76	267.0	177.7	177.1R	706,810	720,586
July	1989	—	—	179.3	178.8R	711,648	775,002
Aug	1989	—	—	181.8	180.7R	703,812	793,475
Sept	1989	119.76	280.2	183.4	181.7R	—	—
Oct	1989	—	—	185.1	183.9R	—	—
Nov	1989	—	—	187.0	185.6	—	—

P = Preliminary R = Revised since last month

¹Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

²Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

³Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 236.

⁴Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

⁵Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

GOVERNMENT STATISTICS

UNITED STATES									
		Producer Price Index ¹		Consumer Price Index ²	GNP Implicit Price Deflator ³	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
Jan	1989	109.4	110.5	121.1	—	13.80	13.49	12.85	10.27
Feb	1989	110.1	110.8	121.6	—	13.66	13.48	12.88	10.26
Mar	1989	110.5	111.5	122.3	125.4	13.71	13.51	12.91	10.30
Apr	1989	111.8	112.3	123.1	—	13.68	13.65	12.92	10.31
May	1989	112.1	113.2	123.8	—	13.60	13.57	12.98	10.33
June	1989	112.4	112.9	124.1	126.0	13.62	13.66	12.98	10.37
July	1989	112.2	112.8	124.4	—	13.70	13.75	13.12	10.41
Aug	1989	111.4	112.0	124.6	—	13.64	13.72	13.08	10.40
Sept	1989	111.9	112.3	125.0	126.8	13.70	13.99	13.18	10.47
Oct	1989	112.4	112.7	125.6	—	13.76R	13.94R	13.25R	10.43R
Nov	1989	112.2	112.7	125.9	—	13.66P	14.12P	13.26R	10.47R
Dec	1989	112.3	113.0	126.1	128.0	—	—	13.28P	10.52P

P = Preliminary R = Revised since last month

¹US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

²US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

³US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

⁴US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

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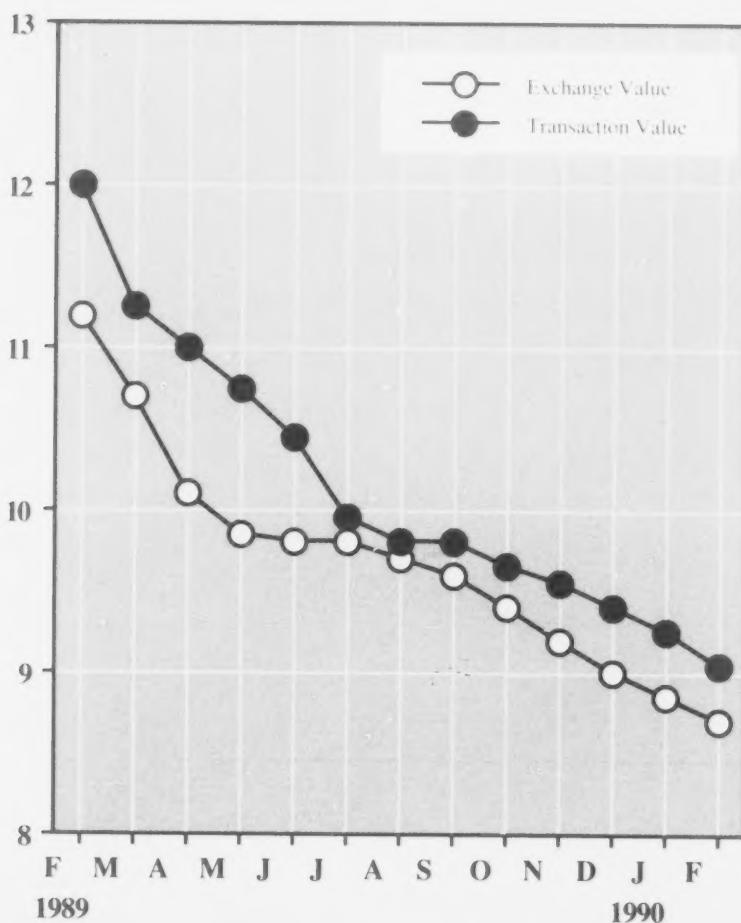
NUEXCO

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March 1990

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NUEXCO MONTHLY REPORT
March 1990, No. 259

EXECUTIVE SUMMARY
(As of February 28, 1990)

Exchange Value
\$8.70, down \$0.15

The Exchange Value is \$8.70 per pound U₃O₈, down \$0.15 from the previous month.

UF₆ Value
\$25.25, down \$0.65

The UF₆ Value is \$25.25 per kg U as UF₆ this month, a \$0.65 decrease from last month's UF₆ value of \$25.90.

Uranium Sales;
Supply and
Demand

Eight recent **natural uranium** sales involving **3.0 million** pounds equivalent U₃O₈ are reported during a very active February. All of these sales involved spot or near-term delivery and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **5.1 million** pounds U₃O₈ equivalent, down from 6.2 million pounds at the end of January. Active spot and near-term **uranium demand** totals **3.7 million** pounds, compared to 2.5 million pounds last month. The spot and near-term **supply-demand ratio** is **1.4 to 1**, down from the prior month's 2.5 to 1.

Transaction Value
\$9.05, down \$0.20

The **Transaction Value** is **\$9.05** per pound U₃O₈, down \$0.20 from last month. The calculation includes 22 transactions involving a total of 5.8 million pounds U₃O₈ equivalent over a period of three months.

Loan Rate
3.5%, unchanged

The **Loan Rate** is **3.5 percent** per annum, as has been the case for 28 consecutive months. Four natural uranium loans are reported, involving over 1.5 million pounds U₃O₈ equivalent.

Conversion Value
\$1.50, unchanged

The **Conversion Value** is unchanged at **\$1.50** per pound U as UF₆. No transactions for conversion services are reported.

SWU Value
\$50, down \$4

The **SWU Value** decreased \$4 to **\$50** per SWU. Two SWU sales are reported. Active supply decreased from 665 to 415 thousand SWU, and active demand dropped from 400 to 265 thousand SWU.

* * *

Perestroika and the
Mining Industry

Perestroika in the Soviet Union and Eastern Europe will necessitate some restructuring of the mining industry of the Western world. Tremendous opportunities will be available to companies that adapt most readily.

Technical Analysis in
Short-Term Uranium
Price Forecasting

Given the relatively small field of uranium price data points, technical analysis, as applied to other commodities, should not be directly applied to uranium. However, due to the basically non-random nature of past uranium price movements, technical analysis may help anticipate future price trends.

Major Issues Facing
Research Reactor
Operators

Over 300 research reactors operate in more than fifty countries. Unless serious issues in the areas of supply availability, reactor design, reprocessing, and spent fuel storage are resolved soon, several could suffer temporary suspension of operation. They may also have to seek new sources of high-enriched fuel, as well as new storage facilities for spent fuel.

NUEXCO MONTHLY REPORT 259 FIGURES OF THE MONTH (February 28, 1990)	This Month (Report 259)	Last Month (Report 258)	12 Months Ago (Report 247)
Exchange Value (SUS per pound U ₃ O ₈)	8.70	8.85	11.20
UF₆ Value (SUS per kg U as UF ₆)	25.25	25.90	34.00
Transaction Value (SUS per pound U ₃ O ₈ equivalent)	9.05	9.25	12.00
Loan Rate (Per Annum)	3.5%	3.5%	3.5%
Conversion Value (SUS per pound U as UF ₆)	1.50	1.50	1.95
Near-Term Uranium Supply ¹ (millions of pounds U ₃ O ₈)	5.1	6.2	6.2
Near-Term Uranium Demand ² (millions of pounds U ₃ O ₈)	3.7	2.5	3.1
Near-Term Supply-Demand Ratio	1.4	2.5	2.0
Recent Uranium Sales: ³			
Number of Transactions	17	6	8
Quantity of Material (Millions of pounds U ₃ O ₈ equivalent)	15.1 ⁴	5.1	6.5
Nuexco SWU Value: (SUS per SWU)			
at 0.3 tails assay	50	54	67
US DOE SWU Prices: (SUS per SWU)			
USEC	117.85 ⁵	117.85 ⁵	117.00 ⁶
AFC	153.00 ⁷	153.00 ⁷	153.00 ⁷
Requirements	157.00 ⁷	157.00 ⁷	157.00 ⁷
Incentive Price (IP1)	90.00 ⁸	90.00 ⁸	90.00 ⁸
Market Value of Enriched UF₆ ⁹ : (SUS per kg U as UF ₆)			
2.5 w/o U ₂₃₅	266	279	350
3.0 w/o U ₂₃₅	342	359	450
3.5 w/o U ₂₃₅	420	440	552
4.0 w/o U ₂₃₅	498	523	656

¹ Active inquiries to sell, for delivery within 12 months after contract signing.

² Active inquiries to purchase, for delivery within 12 months after contract signing.

³ Uranium sales only; does not include loans, conversion, or SWU transactions.

⁴ Includes 8 transactions concluded prior to February 1, 1990.

⁵ Effective 10/1/89 to 9/31/90.

⁶ Effective from 10/1/87 to 9/31/89.

⁷ Effective since 10/1/84.

⁸ Effective from 10/1/86 to 9/31/90, for up to 30% of annual requirements. DOE chose to waive application of the GNP deflator for FY87-FY90 deliveries.

⁹ Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

NUEXCO

Monthly Report

March 1990
No. 259

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To Our Readers

We are pleased to announce that **Mr. R. Scott Lumadue** has joined the NUEXCO organization.

Since 1981, Scott has worked in the purchasing department of Duke Power Company, progressing to his most recent position as Purchasing Agent for Nuclear Fuel Purchasing. Prior to his move to purchasing, Scott worked in Duke's Steam Production Department. Scott earned his BS degree in Accounting from Appalachian State University in 1977.

Based in Denver, Scott will be responsible for Contract Administration and trading support for NUEXCO Trading Corporation.



* * *

NUEXCO will be hosting a hospitality suite at the US Council for Energy Awareness Fuel Cycle '90 Conference to be held March 25-28 in Nashville, Tennessee. We look forward to seeing you there.

MARKET VALUES SUMMARY

February 28, 1990

Market Values	This Month (Report 259)	Active Supply* (thousands pounds equivalent U ₃ O ₈)	Active Demand* (thousands pounds equivalent U ₃ O ₈)
EXCHANGE VALUE	\$8.70/lb U ₃ O ₈		
U ₆ VALUE	\$25.25/kg U ₆ as U ₃ O ₈	5,140**	3,720**
LOAN RATE	3.5% annum	6,920	0
CONVERSION VALUE	\$1.50/lb U ₃ as U ₆	990	560
SWU VALUE ¹ 0.3 tails assay:	\$50/SWU	415	265
TRANSACTION VALUE ²	\$9.05 Per Pound U ₃ O ₈	22 Transactions	3 Months
			5.8 Million Pounds

* Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

** Includes uranium concentrates and uranium hexafluoride.

DEFINITIONS

¹ The **Exchange Value** is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

² The **U₆ Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

³ The **Loan Rate** is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

⁴ The **Conversion Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

⁵ The **SWU Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

⁶ The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:

- Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
- At least ten transactions;
- Transactions involving a sum total of at least 2 million pounds U₃O₈ equivalent.

DERIVATIONS AND COMMENTS

- All **Market Values** are based on:
 - Data from recently completed transactions.
 - Data from pending transactions.
 - Firm bids to buy or borrow, and firm offers to sell or lend.
 - Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend.

- Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these **Market Values**.

- In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers.

- The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.

- For the **SWU Value**, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the NUEXCO **Exchange Value** and **Conversion Value** determined as of the same date.

- In calculating the **Transaction Value**, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future **Exchange Values** or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined.

- The sample time for the **Transaction Value** is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

PRICING

FEBRUARY MARKET REVIEW

(as of February 28, 1990)

NATURAL URANIUM AND CONVERSION

Short-term Market Activity

Intense competition for sales led to declines in most NUEXCO Market Values in a very active month of trading. Both the spot and long-term markets generated high sales volume in February. Nearly three million pounds equivalent U₃O₈ changed hands in eight near-term uranium sales. Six involved natural uranium concentrates, one involved UF₆, and the other enriched uranium product (EUP). In addition, several inquiries and offers are pending. In other markets, four natural uranium loans and two enrichment sales are reported.

Seven short-term uranium sales concluded in December or January are also reported. They amounted to approximately 1.3 million pounds equivalent U₃O₈, and are not included in the February market volume totals. Six of those will be posted in the totals reported in the *1989 Annual Review*; the seventh, a very small UF₆ sale, will be included in the 1990 totals.

The **Exchange Value** fell to \$8.70 per pound U₃O₈, down almost two percent from \$8.85 on January 31. Spot market volume increased significantly, as market participants pursued opportunities more vigorously than in recent months. Some of the recent purchases may be due to perceptions by some buyers that the market may be nearing its bottom. Six spot yellowcake sales occurred at or near the February 28 Exchange Value.

Heavy sellers' competition for each opportunity continues to exert downward pressure on the market. Producers have also become an important force in the marketplace, by borrowing or buying material in order to fulfill long-term commitments. This trend has been developing gradually, and recent months have seen substantial volumes and numerous transactions with producers in previously non-traditional roles as buyers or borrowers.

The **UF₆ Value** declined to \$25.25 per KgU as UF₆, down \$0.65. One large UF₆ sale to a producer is reported this month. The UF₆ Value is under additional pressure from competitive EUP sales. While adequate supplies of EUP remain available, recent transactions have reduced inventory levels somewhat.

The **Transaction Value** dropped to \$9.05 per pound U₃O₈, based on 22 qualifying sales totalling 5.8 million pounds over a three-month period.

Active Supply of natural uranium declined to 5.1 million pounds equivalent U₃O₈, from 6.2 million pounds on January 31. **Active Demand** for natural uranium increased to 3.7 million pounds equivalent U₃O₈, from 2.5 million pounds. The **Supply/Demand Ratio** dropped to 1.4 compared to the January 31 ratio of 2.5.

The **Loan Rate** remains unchanged at 3.5 percent per annum. Four loans amounting to over 1.5 million pounds occurred at or near the February 28 Loan Rate. The loans involved two producers, an intermediary, and a utility as lenders. Natural uranium loan supply remains abundant. Large quantities of material are being loaned to meet immediate supply obligations. Borrowers are covering their return obligations through medium-term purchases or planned production. This trading activity is one of the numerous ways in which the liquidation of excess inventories in all segments is driving the nuclear fuel market.

PRICING

The **Conversion Value** also remains unchanged at \$1.50 per pound U as UF₆. Market activity was very light in this sector; no spot conversion sales are reported. One long-term sale by a converter, which occurred in late 1989, is listed under Conversion Transactions on page 10.

Long-term Market Activity

The long-term natural uranium market was very active as well; most sales involved US utilities as buyers. Nine long-term sales, totalling over 12 million pounds equivalent U₃O₈, all based on market-related pricing, were concluded in February. Competition remains intense in this market also; aggressive sellers are eager to pursue this recent reawakening of demand for long-term supplies.

One utility issued letters of intent to several different sources, including producers and intermediaries, for long-term supply contracts. One long-term UF₆ sale that occurred in December is reported in this month's transactions. It will be included in the totals published in the *1989 Annual Review*.

ENRICHED URANIUM PRODUCT AND ENRICHMENT SERVICES

Current Market Activity

The **SWU Value** dropped \$4 to \$50 per SWU. US utilities made one SWU purchase and one EUP purchase; three additional SWU sales are pending.

The current activity is largely attributable to the liquidation of substantial inventories of EUP. Some EUP sales involve inventories held by utilities and others that have no actual needs. With the present market situation, demand for EUP rather than its components is increasing. Nevertheless, more utilities are becoming interested in the SWU spot market.

The surge of inventories into the marketplace has pushed SWU market prices down to such a level that market economics are being reexamined. The low SWU market

prices, coupled with the perception of abundant long-term SWU supplies from the worldwide enrichment overcapacity, has led several utilities to consider the cost of terminating portions of their long-term enrichment contracts. In particular, some DOE customers have become dissatisfied with the terms of their Utility Services Enrichment Contracts (USEC). While some are evaluating the economic impact of termination, others are considering legal challenges to the contract itself.

Interpretation of the USEC

Although the validity and interpretation of the Department of Energy's (DOE) USEC have been discussed since the contract was first introduced in 1984, customers have never seriously challenged the interpretations set forth by DOE. However, several developments have led some of DOE's utility customers to reconsider their rights and obligations under the contract. The following discussion reports some of those utilities' concerns.

- DOE has unilaterally taken new steps to restrict the freedom of USEC holders. For example, utilities that are 100% DOE customers are no longer able to use the separative work (SWU) that they take from DOE to upgrade enriched uranium. That restriction reduces the value of DOE SWU to such utilities that have access to enriched feed material.
- For the first time in the history of the commercial nuclear fuel market, the ability for utilities to purchase fabricated fuel is now becoming widely available. Several fuel fabricators hold large inventories of EUP and can offer later EUP fuel delivery dates, or even sell EUP directly to the utility. It is not clear how DOE would apply such transactions against the requirements in each customer's USEC.
- DOE is selling SWU to 70% customers for a full price of about \$120, and that price is expected to rise to \$140. Current spot market prices are in the neighborhood of \$50. Regulatory authorities are

PRICING

putting increased pressure on utilities to reduce costs, such that price differentials can become embarrassing.

- The DOE program, Atomic Vapor Laser Isotope Separation (AVLIS), that was projected to enrich uranium at costs substantially below the current market price, remains an unproven technology without a firm deployment schedule. The previous DOE program, the Gas Centrifuge Enrichment Plant, was scrapped after billions of dollars had been spent. But in the hands of Soviet, European, and Japanese suppliers, this same gas centrifuge technology appears to be capable of lower cost production than DOE's aging diffusion plant technology.

- The delays in DOE's spent fuel disposal program have cast doubt on DOE's ability to manage large technical projects such as AVLIS.

- Finally, some utilities and industry associations have hired outside legal counsel to review the USEC, and their opinions seem to suggest that the utilities may have more freedom under the contract than they have exercised in the past.

Requirements

The most significant interpretation issue is the requirement for a utility to purchase enrichment services from DOE. This issue has two important areas of uncertainty. The first is the definition of requirements. What is a requirement for enrichment services and when does the requirement arise? When DOE was the only source, requirements for enrichment were much easier to determine. Even then, however, there were other questions. How is a damaged fuel bundle treated? Are fabrication losses a requirement if the fabricator is responsible for the lost material? Now that utilities can purchase enriched uranium, fabricated fuel, or electrical power generated by nuclear fuel, the question of when a utility has a requirement is debatable.

The timing question was difficult to deal with in the past and is even more so now. Past practices seemed to indicate that a utility must recognize a requirement when the

fabrication contract required delivery of enriched feed. That practice did not work well in the past, when it did not have to deal with inventories, loans, or special contractual provisions. Now it is even more difficult. Fabricators hold large inventories of enriched uranium, enabling utilities to delay the requirement to deliver feed material for long periods of time or to reduce the requirement to zero by purchasing fabricated fuel.

The second important area of uncertainty is the question of how a utility can use its enrichment services once a requirement has been recognized. Enriched uranium from various sources is available at low prices, but it sometimes needs to be upgraded to an appropriate assay. Utilities could gain a significant cost savings if, rather than suffering the economic penalty associated with blending, they could use enrichment services to upgrade. DOE allowed this in the past. Utilities could profit from the sale of DOE-origin enrichment to other utilities that wanted DOE material. In its place, they could substitute lower cost material with the same or better isotopic and chemical specifications. DOE now denies 100% customers this practice.

Termination Charges

Are the charges demanded by DOE valid termination charges or an illegal forfeiture? The 70% DOE customers face a different situation than the 100% or Incentive Price (IP) customers. The IP has been described as a contract based on marginal cost and, if that is true, some IP customers may argue that their legally enforceable termination charges may be different from the charges that could be assessed on others.

Equal Treatment

What is DOE's responsibility to ensure equal treatment? Has DOE met the standards? Outside counsel who offer a pledge of confidentiality may not be allowed to verify equal treatment by reviewing the DOE contracts. Does the requirement that the West German national stockpile not be offered by DOE to US utility customers violate the standard? Who has been allowed to upgrade in the past? Who has not? The question of equal treatment prompts a number of other questions.

Cost Projections

DOE has used cost projections as a marketing tool. Some customers may argue that they were misled by those cost projections. Some utility fuel managers are interested in examining the legal ramifications of using such projections in marketing, as well as the utility's rights if such projections were, in a legal sense, incorrect, negligent, or fraudulent.

Pricing and Cost Accounting

Utilities now deal with a contract that has a ceiling price determined by the sum of various costing formulae. The largest component of the ceiling price formula is the average power cost, which is equal to one quarter of the preceding fiscal year's power cost. Some customers are concerned that this component could be subject to manipulation by DOE. DOE's cost accounting has been criticized by the General Accounting Office (GAO) and the Congressional Research Service, as well as by utilities. Consequently, some utilities want to become more involved in such cost accounting.

Conclusion

The history of enrichment contracting is one of periodic adaptation to changes in market conditions, usually in response to customer requests. The US Atomic Energy Commission (now DOE) offered requirements contracts between 1968 and 1972. For the next ten years or so, fixed commitment contracting dominated the market, first as the Long-term Fixed-commitment Contract (LTFC), then as the Adjustable Fixed-commitment Contract (AFC) in 1978. In August 1982, DOE introduced the draft Facility Requirements Contract, which later evolved into the USEC and was first offered in January 1984.

DOE's competition has come from Eurodif (since 1979), Urenco (since 1976), and the Soviet Union (since 1973). After initially concentrating on Europe and Asia, DOE's competitors have become more aggressive during the life of the USEC, substantially increasing their penetration of DOE's domestic market. Further competition from the emerging Louisiana Energy Services and Isotope Technologies may arise in the mid-1990's. Inasmuch as DOE enrichment contract forms have a useful commercial life of four to six years, and inasmuch as the USEC is now more than six years old, perhaps DOE should consider the development of a new contract paying close attention to its customers' current needs. ■

CURRENT MARKET DATA

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

EXCHANGE VALUE						
Country (currency)	per lb U308 as Concentrates			per kg U as Concentrates		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	11.47	11.58	14.07	29.82	30.10	36.58
Belgium (comm. franc)	306.01	313.27	427.64	795.57	814.44	1,112
Canada (dollar)	10.39	10.52	13.46	27.01	27.34	34.99
EEC (ecu)	7.19	7.28	9.78	18.68	18.94	25.43
Finland (markka)	34.51	35.49	47.82	89.73	92.26	124.33
France (franc)	49.69	51.14	69.39	129.19	132.96	180.41
Italy (lira)	10,860	11,204	20.38	28,234	29,128	52.98
Japan (yen)	1,293	1,286	15,032	3,362	3,343	39,079
Netherlands (guilder)	16.54	16.99	1,418	43.01	44.18	3,687
So. Africa (comm. rand)	22.21	22.55	23.04	57.73	58.62	59.60
Spain (peseta)	944.42	967.11	27.78	2,455	2,514	72.22
Sweden (krona)	53.08	54.90	1,278	138.00	142.73	3,322
Switzerland (franc)	12.91	13.31	70.26	33.55	34.60	182.67
UK (pound)	5.15	5.28	17.39	13.38	13.73	45.22
US (dollar)	8.70	8.85	6.44	22.62	23.01	16.74
West Germany (mark)	14.68	15.06	11.20	38.15	39.16	29.12

TRANSACTION VALUE						
Country (currency)	per lb U308 as Concentrates			per kg U as Concentrates		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	11.93	12.10	15.08	31.02	31.46	39.19
Belgium (comm. franc)	318.33	327.43	458.19	827.58	851.25	1,191
Canada (dollar)	10.81	10.99	14.42	28.09	28.58	37.49
EEC (ecu)	7.48	7.61	10.48	19.43	19.79	27.24
Finland (markka)	35.90	37.09	51.24	93.34	96.43	133.21
France (franc)	51.69	53.46	74.35	134.39	138.97	193.29
Italy (lira)	11,297	11,710	21.83	29,370	30,444	56.76
Japan (yen)	1,345	1,344	16,105	3,498	3,494	41,870
Netherlands (guilder)	17.21	17.76	1,519	44.74	46.17	3,950
So. Africa (comm. rand)	23.10	23.57	24.69	60.05	61.27	64.18
Spain (peseta)	982.41	1,011	29.76	2,554	2,628	77.37
Sweden (krona)	55.22	57.38	1,369	143.55	149.18	3,560
Switzerland (franc)	13.43	13.91	75.28	34.90	36.17	195.72
UK (pound)	5.36	5.52	18.64	13.92	14.35	48.45
US (dollar)	9.05	9.25	6.90	23.53	24.05	17.93
West Germany (mark)	15.27	15.74	12.00	39.69	40.93	31.20

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

CURRENT MARKET DATA
CONVERSION VALUE

Country (currency)	per lb U as UF ₆			per kg U as UF ₆		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	1.98	1.96	2.45	4.36	4.33	5.40
Belgium (comm. franc)	52.76	53.10	74.46	116.32	117.06	164.15
Canada (dollar)	1.79	1.78	2.34	3.95	3.93	5.17
EEC (ecu)	1.24	1.23	1.70	2.73	2.72	3.75
Finland (markka)	5.95	6.01	8.33	13.12	13.26	18.36
France (franc)	8.57	8.67	12.08	18.89	19.11	26.64
Italy (lira)	1,872	1,899	3.55	4,128	4,187	7.82
Japan (yen)	222.98	217.96	2,617	491.59	480.52	5,770
Netherlands (guilder)	2.85	2.88	246.90	6.29	6.35	544.32
So. Africa (comm. rand)	3.83	3.82	4.01	8.44	8.43	8.84
Spain (peseta)	162.83	163.92	4.84	358.98	361.37	10.66
Sweden (krona)	9.15	9.31	222.50	20.18	20.51	490.53
Switzerland (franc)	2.23	2.26	12.23	4.91	4.97	26.97
UK (pound)	.89	.89	3.03	1.96	1.97	6.68
US (dollar)	1.50	1.50	1.12	3.31	3.31	2.47
West Germany (mark)	2.53	2.55	1.95	5.58	5.63	4.30

SWU VALUE AND UF₆ VALUE

Country (currency)	SWU Value at 0.30% Tails Assay			UF ₆ Value per kg U as UF ₆		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	65.92	70.63	84.17	33.28	33.87	42.71
Belgium (comm. franc)	1,759	1,912	2,558	888.14	916.81	1,298
Canada (dollar)	59.70	64.18	80.51	30.14	30.78	40.85
EEC (ecu)	41.30	44.45	58.50	20.85	21.31	29.68
Finland (markka)	198.35	216.54	286.08	100.16	103.85	145.17
France (franc)	285.60	312.07	415.12	144.22	149.67	210.65
Italy (lira)	62,414	68,363	121.91	31,519	32,789	61.86
Japan (yen)	7,433	7,847	89,921	3,754	3,763	45,631
Netherlands (guilder)	95.08	103.69	8,483	48.01	49.73	4,305
So. Africa (comm. rand)	127.62	137.58	137.83	64.44	65.98	69.94
Spain (peseta)	5,428	5,901	166.17	2,741	2,830	84.32
Sweden (krona)	305.06	334.99	7,645	154.05	160.66	3,880
Switzerland (franc)	74.17	81.22	420.33	37.45	38.95	213.29
UK (pound)	29.59	32.22	104.05	14.94	15.45	52.80
US (dollar)	50.00	54.00	38.52	25.25	25.90	19.54
West Germany (mark)	84.35	91.91	67.00	42.59	44.08	34.00

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.



CURRENT MARKET DATA

RECENT TRANSACTIONS

URANIUM SALES ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U ₃ O ₈ equivalent)	Approximate Price Range ² as Percent of Current Exchange or UF ₆ Value	Seller	Buyer	Remarks
4721	1990-91	301-600	R ³	Producer	Utility	UF ₆ , Occurred in Late 1989
4722	1990	301-600	R ³	Producer	Utility	UF ₆ , Occurred in Late 1989
4737	1990	50-100	103-107	Intermediary	Utility	Occurred in Late 1989
4738	1990	Less Than 50	R ³	R ³	Intermediary	UF ₆ , Occurred in January
4739	1991-96	1,001-3,000	See Remarks	Producer	Utility	Price Related to Market
4740	1991-96	1,001-3,000	See Remarks	Producer	Utility	Price Related to Market
4742	1990	301-600	103-107	Intermediary	Producer	UF ₆ , Occurred in Late 1989
4744	1990	301-600	108-112	Utility	Intermediary	UF ₆ , Occurred in Late 1989
4745	1989	50-100	108-112	Utility	Intermediary	Occurred in Late 1989
4746	1989	50-100	103-107	Utility	Producer	Occurred in Late 1989
4747	1990	301-600	98-102	Intermediary	R ³	
4748	1990	101-300	98-102	Intermediary	Utility	
¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information. ² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range. ³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.						

CURRENT MARKET DATA

URANIUM SALES¹ (continued)						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U₃O₈ equivalent)	Approximate Price Range² as Percent of Current Exchange or UF₆ Value	Seller	Buyer	Remarks
4749	1992-97	1,001-3,000	See Remarks	R ³	Utility	Price Related to Market
4750	1990-95	301-600	See Remarks	Intermediary	Utility	UF ₆ , Price Related to Market
4753	1990	50-100	98-102	Intermediary	Utility	
4756	1990	601-1,000	98-102	Intermediary	Producer	UF ₆
4757	1990	50-100	98-102	Intermediary	Producer	
4759	1992-96	1,001-3,000	See Remarks	Intermediary	Utility	Price Related to Market
4760	1992-96	1,001-3,000	See Remarks	Producer	Utility	Price Related to Market
4761	1992-96	1,001-3,000	See Remarks	Producer	Utility	Price Related to Market
4762	1992-96	1,001-3,000	See Remarks	Producer	Utility	Price Related to Market
4763	1992-96	1,000-3,000	See Remarks	R ³	Utility	Price Related to Market
4768	1990	101-300	98-102	Intermediary	Intermediary	
4769	1990	301-600	98-102	Intermediary	Utility	
4770A	1990	101-300	See Remarks	Intermediary	Utility	Contained in EUP

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.



CURRENT MARKET DATA

NATURAL URANIUM LOAN TRANSACTIONS ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U ₃ O ₈ equivalent)	Approximate Price Range ² as Percent of Current Loan Rate	Lender	Borrower	Remark
4754	1990	301-600	98-102	Producer	Intermediary	
4755	1990	101-300	98-102	Producer	Intermediary	
4758	1990	601-1,000	98-102	Intermediary	R ³	
4766	1990	301-600	98-102	Utility	Intermediary	
CONVERSION SERVICES SPOT MARKET SALES ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U equivalent)	Approximate Price Range ² as Percent of Current C.V.	Seller	Buyer	Remark
4741	1990-91	301-600	R ³	Converter	R ³	
ENRICHMENT SERVICES SECONDARY MARKET SALES ¹						
NUEXCO Transaction Period	Delivery	Approximate Quantity ⁴ (thousand SWUs)	Approximate Price Range ² as Percent of Current SWU Value ⁵	Number Seller	Buyer	Remarks
4752	1990	50-100	98-102	Intermediary	Utility	
4770B	1990	50-100	See Remarks	Producer	Utility	Contained in EUP
¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information. ² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range. ³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality. ⁴ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 % tails assay. ⁵ Prices are usually normalized to 0.30% tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.						

CURRENT MARKET DATA

URANIUM SUPPLY (February 28, 1990)			
Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
88-1096A	965	—	1990, UF ₆
89-1001	1,300	1,300 per year	1990-93, UF ₆
89-1201*	2,000	3,000 per year	1990-93
89-1252	375	375 per year	1990-96
89-7000A	500	—	1990, UF ₆
90-1027*	—	300 per year	1991-2000
Total	5,140		
INACTIVE			
89-1076	500	250 per year	1990 on
89-1128*	1,130	—	1990, UF ₆
89-1156	200	—	1990
89-1173*	750	—	1990
89-1180*	1,000	—	1990
89-1209	400	400 per year	1990-93
90-1000A	655	—	1990, UF ₆
87-1000	—	600 per year	1991-95
87-1123	—	1,000 per year	1990 on
88-1157	—	1,000 per year	1990 on, UF ₆
Total	4,635		
* New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 89-1029, 89-1188, 90-1003.			



CURRENT MARKET DATA

URANIUM DEMAND (February 28, 1990)			
Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Inquiries to Purchase: ACTIVE			
89-1183	400	—	1990
89-1229	100	—	1990
90-1019A*	250	—	1990, UF ₆ e
90-1020A*	365	—	1990, UF ₆ e
90-1026*	100	—	1990
90-1034*	300	—	1990
90-1038*	800	—	1990-91
90-1045A*	405	—	1991, UF ₆ e
90-1046*	600	—	1990
90-1048*	400	—	1990
.....			
89-1090	—	150 per year	1991-96
89-1233	—	160	1991, UF ₆
89-1254	—	270 per year	1991-2000
89-1256	—	200 per year	1991-94
89-1260	—	250 per year	1992-94
90-1017	—	500	1991
90-1024*	—	250 per year	1992-2001
Total	3,720		
INACTIVE			
89-1067	500	—	1990
89-1175	170	170 per year	1990-91
90-1001*	350	—	1990
90-1008*	130	—	1990
Total	1,150		
* New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 88-1227, 89-1163, 89-1172, 89-1176, 89-1192, 89-1218, 89-1236, 89-1242, 90-1009, 90-1015.			

CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND (February 28, 1990)			
Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
88-1182	4,000	—	U ₃ O ₈ /UF ₆
89-1225*	500	—	U ₃ O ₈
90-1016*	300	—	U ₃ O ₈
90-1031*	500	—	U ₃ O ₈
90-1033*	1,270	—	UF ₆
90-1036*	100	—	U ₃ O ₈
90-1041*	250	—	U ₃ O ₈
Total	6,920		
INACTIVE			
None reported			
Inquiries to Borrow:			
None reported			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 89-1186, 89-1248.			



CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND (February 28, 1990)			
Delivery Period ¹ (Thousand Pounds of U as UF ₆)			
NUEXCO Project Number	Within 3 Years	Beyond 3 Years	Remarks
Available for Sale			
ACTIVE			
89-7000C	400	—	
89-7001A	440	—	
89-7002*	150	—	
Total	990		
INACTIVE			
<i>None reported</i>			
Inquiries to Purchase			
ACTIVE			
90-1028*	385	—	
90-1040*	175	—	
Total	560		
INACTIVE			
<i>None reported</i>			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 89-1245.			

CURRENT MARKET DATA

SWU SUPPLY AND DEMAND (February 28, 1990)			
NUEXCO Project Number	Delivery Period ¹ (Thousand SWUs)		Remarks
	Spot or Near-term ²	Intermediate or Long-term	
Available for Sale			
ACTIVE			
88-1082	100		1990
88-1096B	140		1990, UFree
89-7000B*	100		1990
89-7001B*	75		1990
Total	415		
INACTIVE			
88-1210	200	200 per year	1990-93
90-1000B	150	—	1990, UFree
Total	350		
Inquiries to Purchase			
ACTIVE			
90-1019B*	55		1990, UFree
90-1020B*	80		1990, UFree
90-1032*	35		1990
90-1045B*	95		1990, UFree
88-1061		500	1991-95
89-1262	—	120 per year	1996-99
90-1022A*	—	235 per year	1996-95
90-1022B*	—	900 per year	2000-13
Total	265		
INACTIVE			
89-1043	50	—	1990
89-1047	—	600	1991-95
Total	50		
* New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 88-1236, 89-1243.			

RECENT DEVELOPMENTS

RECENT DEVELOPMENTS IN THE USA

1988 US Uranium Industry Viability

For the fifth consecutive year, the U.S. Secretary of Energy has determined that the domestic uranium mining and milling industry was not viable. The latest determination applied to Calendar Year 1988. Since 1983, the Secretary has been required, under Section 170B of the Atomic Energy Act of 1954, 42 U.S.C. 2210 B, to conduct this determination annually. The industry was found to be viable only in the first year studied—1981.

The Secretary evaluates the state of the industry on the basis of four primary criteria:

- resource capability;
- supply response capability;
- financial capability;
- import commitment dependency.

Resource capability refers to the extent to which domestic economic uranium reserves can supply all domestic needs for a future ten year period. Based on estimates supplied by U.S. producers, sufficient reserves exist to satisfy this condition under a number of future scenarios.

Supply response capability is the domestic production capability available to meet domestic nuclear power needs for a ten year period. According to the Energy Information Agency (EIA), the industry would be able to fulfill cumulative uranium security requirements if a disruption were to occur in early 1990. If a disruption were to occur in the 1996-2005 period, production capacity, supplemented by inventory drawdowns in some of the years, would adequately cover reactor needs. In subsequent years, the production capacity is expected to increase, if necessary, to the levels needed to meet the

requirements. The technical capability of the industry is dependent upon the industry's ability to generate funds. Thus, the supply response capability must be reviewed in conjunction with the financial capability of the industry.

Financial capability is the domestic uranium production industry's ability to obtain funds adequate to finance the level of production capability defined under supply response capability. In the 1988 assessment, neither higher revenues nor improved profitability are foreseen for the uranium production industry in the next few years. And expectations of higher revenues are necessary to attract investors, who, in turn, are necessary for the industry to maintain an adequate supply response capability in the future.

Import Commitment Dependency measures whether executed contracts or options for natural or enriched uranium will result in greater than 37.5 percent of actual or projected domestic uranium requirements being supplied by foreign sources for two consecutive years. In 1987 and 1988, U.S. utilities imported 52.1 percent and 50.8 percent, respectively, of their uranium requirements. The Secretary of Energy is required under the Trade Expansion Act to conduct a study on the possible effects on national security when this level of imports is surpassed for two consecutive years. However, because imports exceeded 37.5 percent of requirements in 1986, the study took place last year and found no threat to national security. Consequently, the requirement to conduct this study is waived for three years.

The Department of Energy intends to work with Congress to address the difficulties faced by the domestic industry. It plans to continue its efforts to obtain long-term sales contracts outside the USA, and will seek enactment of legislation to create a Government corporation for uranium enrichment. □

RECENT DEVELOPMENTS**Seabrook Operation Approved**

Seventeen years after its owners first applied for a construction license, the Seabrook nuclear reactor received permission to operate commercially. On March 1, the Nuclear Regulatory Commission (NRC) granted Seabrook a full-power operating license, and Public Service Company of New Hampshire (PSNH), its lead owner, expects to place it in commercial operation by summer. Opponents have promised to appeal the NRC decision.

The Seabrook plant has one of the most controversial histories among US nuclear plants. Following the Three Mile Island reactor accident in 1979, and the establishment of a ten-mile emergency planning zone around all nuclear plants, opponents alleged the area around Seabrook could not be safely evacuated in the event of an emergency. In 1986, Michael Dukakis, governor of neighboring Massachusetts, refused to allow the State to participate in any emergency planning. Licensing of the reactor

remained at a stalemate for the next few years, while Seabrook's costs steadily escalated. Finally, in January 1988, PSNH became the first investor-owned utility to file bankruptcy, its investment in Seabrook having reached \$2.1 billion.

The Federal Government intervened in November 1988, and the President issued an executive order allowing the Federal Government to prepare emergency plans when state and local governments refused to participate. The following month, Seabrook's owners submitted an evacuation plan, which the NRC subsequently approved.

The NRC granted Seabrook a low-power operating license in May 1989, and six months later approved the emergency evacuation plan for Massachusetts. The NRC's issuance of a full-power license has been expected for some time, and is clearly a victory for the US nuclear industry. Once Seabrook begins providing much-needed electricity to the Northeast, the USA will have 111 licensed commercial nuclear reactors. ■

RECENT DEVELOPMENTS

WASHINGTON FOCUS

The Senate spent much of the month behind closed doors working on compromises to the Clean Air Bill. Congress has begun the initial round of hearings on the Administration's budget. In March, the appropriations committees in the House will begin the process of creating their own budget bill. The process to elevate the Environmental Protection Agency (EPA) from an agency to a cabinet level department has begun.

Sanctions Against South Africa

The House Foreign Affairs Committee and the Banking, Finance and Urban Affairs Committee held a joint hearing on February 22 to discuss additional sanctions against South Africa. Herman Cohen, Assistant Secretary of State for South Africa, and Richard Newcomb, Director of the Office of Foreign Assets Control at the Treasury Department, testified for the Administration on current policy toward South Africa. Members of the committee and Mr. Cohen all acknowledged that the US Government is hard at work to present a unified policy regarding South Africa and that they intend to continue to consult with each other before taking any action.

Rep. Fauntroy (D-DC) introduced HR 3458 (the South African Financial Sanctions Act of 1990) to increase the pressure on the South African government to end apartheid. The Administration's policy is that the USA continue the course set by the Comprehensive Anti-Apartheid Act of 1986. The State Department would prefer to look at ways to reward the South African government for its efforts to end apartheid rather than punishing it for not moving fast enough.

CEA Nuclear Fuel Supply Committee Meeting

The major announcement at the February 6, CEA Nuclear Fuel Supply Committee meeting was that sanctions against Namibian uranium would be lifted on March 21 by executive order if Namibian independence occurs as scheduled.

Concerning the possible restructuring of DOE's enrichment program, Michael Woo, Rep. John Dingell's (D-MI) staffer on the Energy & Commerce Committee questioned whether there was a real need for restructuring. He added, however, that if DOE's independent financial study (conducted by Smith-Barney) is truly independent and market competitive, then the House might consider a bill on restructuring. He also noted that the Interior Committee will hold a hearing on the Louisiana Energy Services (LES) licensing amendment in March.

Kermit Laughon from DOE provided some specifics on the AVLIS demonstration and deployment plan. He noted that DOE's goal is to make a deployment decision by 1992. A National Academy of Sciences panel will report in two years on other commercial applications for AVLIS technology.

Michael Dimo, Commercial Secretary from the Australian Embassy, reported a potential change in the uranium policy of that government, depending upon the upcoming elections. Parliament returned February 20 and announced the election date for March 24.

Radionuclide Emissions Regulations

On February 13, three environmental groups filed a suit against the EPA's radionuclide air emissions standards. The suit was filed in the US Court of Appeals in Washington, DC by the Natural Resources Defense Council, the Environmental Defense Fund, and Manasota-88 (a group primarily concerned with phosphates). The plaintiffs charge that the standards condone high cancer risks for residents near affected facilities. The EPA has until March 15 to consider new petitions on questions concerning regulation of NRC facilities.

Sniwezek Appointment

James Sniwezek has been appointed NRC deputy executive director, and Frank Miraglia will assume Sniwezek's position as deputy director of the Office of Nuclear Reactor Regulation. Both appointments are effective April 1.

Nuclear Fuel Industry Developments

January

17

In view of improving their competitive position for the 1990s, **Belgium's three primary utilities**—Ureng, Intercom, and Ebes—announced their upcoming **merger**. The new entity will be Belgium's second largest industrial firm, and will operate the country's seven nuclear reactors.

February

The **United Kingdom** became the first country to loosen **sanctions** against **South Africa** as Margaret Thatcher lifted a voluntary ban on new investments in South Africa. The USA is not expected to remove sanctions until much more progress is made toward a democratic, non-racial society.

Early Feb

Due to projections of low uranium prices in the 1990s and uncertainties concerning the Soviet Union's continuing role as Czechoslovakia's primary uranium buyer, **Czechoslovakia's** Ministry of Energy and Fuels announced plans to gradually **phase out uranium production** by the end of the century.

8

The lower house of **Switzerland's** Parliament vetoed two antinuclear initiatives—one banning all nuclear activity for 10 years, and the other barring additional nuclear construction and phasing out operating plants. The upper house is also expected to reject the initiatives.

12

To bolster nuclear electricity sales, **UK** Energy Secretary John Wakeham announced a 10.6% **nuclear tax** on fossil fuel sales. The area electricity distribution companies will be required to buy a total of 8,000 MW of the higher-priced nuclear-generated electricity through 1997-98.

13

NRC Chairman Kenneth Carr expects **delays in NRC licensing of standard plant designs** from the targeted 1992 to the mid-1990s, due to a number of unresolved technical standards.

14

At the urging of West Germany, the **East German** government **shut down** its Greifswald **nuclear reactor** due to safety concerns. In late 1988, East Germany submitted its reactors to Western inspection, and a number of similar-type reactors are expected to be scrutinized for safe operation.

21

France ended a 14-year ban on sales of nuclear services and products to **Pakistan**, by announcing it would build a **nuclear power plant** in Pakistan.

According to a recently released study by the **French government**, large **nuclear power plants** will provide France with the **cheapest source of electricity** into the 21st century.

According to the latest report by the **Swedish National Energy Administration**, closing two **nuclear units** as planned in 1995 would be five times **more costly** than projected in 1988. The new study uses higher electricity demand forecasts and incorporates a tax on replacement fossil fuels that is expected to be approved soon by Parliament.

March

1

The Nuclear Regulatory Agency granted the **Seabrook** nuclear plant in New Hampshire a full-power **operating license**, following years of controversy over emergency planning. (See page 16.)

PERESTROIKA AND THE MINING INDUSTRY

The following summarizes a speech presented by Charles H. Peterson, President of NUEXCO International Corporation, to the National Western Mining Conference in Denver, Colorado on February 7, 1990.

Introduction

The recent events in the Soviet Union and other Eastern European countries have brought new meaning to *perestroika*, the Russian word for restructuring or rebuilding. The course charted by Eastern Europe is irrevocable, and as it progresses, new markets and opportunities for the West will continue to develop. To take advantage of the momentous changes underway in Eastern Europe, the mining industry of the Western World must also undergo restructuring.

Industrial Structure

The typical infrastructure of an Eastern European nation is managed by numerous ministries, which coordinate all aspects of production and consumption. Each ministry

plans, funds, produces, buys, sells, imports, and exports all products related to its area of responsibility. Typically a ministry will provide complete company towns, which include hotels, schools, medical facilities, stores, and everything necessary to meet its production plan.

The large ministries are mostly self-sufficient, with all interministry transactions governed by a central economic plan. Consequently, most ministries have large, internal research and development (R&D) organizations, which are well-staffed and well-equipped.

Exports are handled through authorized export agencies. For instance, Techsnabexport (TENEX) is one of the export agencies for the Ministry of Atomic Energy and Industry in the USSR. **Table 1** lists the most important products that TENEX exports.

Imports are typically controlled by the Economic Planning Ministry, the Ministry of Foreign Trade, and the Bank for Foreign and Economic Affairs. Thus, many different ministries have to approve transactions with the West. But once trading channels have been established and approval has been granted for the first transaction of a particular type, such transactions may be executed repeatedly, provided the established commercial objectives are attained.

Table 1
MAJOR PRODUCTS EXPORTED BY TENEX

• Nuclear Materials - Enriched Uranium - Fuel Assemblies - Conversion and Enrichment Services - Ionizing Radiation Sources - Isotopes • Rare-Earth and Rare-Metal Compounds • Chemical Products - Fertilizers - Ion-Exchange Resins - Acids/Bases - Fluoroplastics - Thermosetting Polyethylene Products	• Machinery and Instruments - Lasers - Accelerators and Cyclotrons - Filters - Measurement and Calibration Equipment - Protective Radiation Equipment - Welding and Cutting Machines - Electronic Detection and Generation Devices - Dosimetric and Radiometric Instruments - Radiation Monitoring Equipment - Radioisotopic Instruments • Mineral Extraction Processes • Laboratory and Medical Equipment	• Mining Equipment - Vibrating Screens and Filters - Vibrating Washers and Dryers - Vibrating Conveyors - Vertical Mills - Synthetic Diamond Drill Bits • Miscellaneous - Emeralds - Pink Granite - Milk Production Equipment - Stepped Linear Electric Motors - Grinding Wheels - Alarm Signaling Systems - Hyperfine Metal Powders
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Mining in the Soviet Union

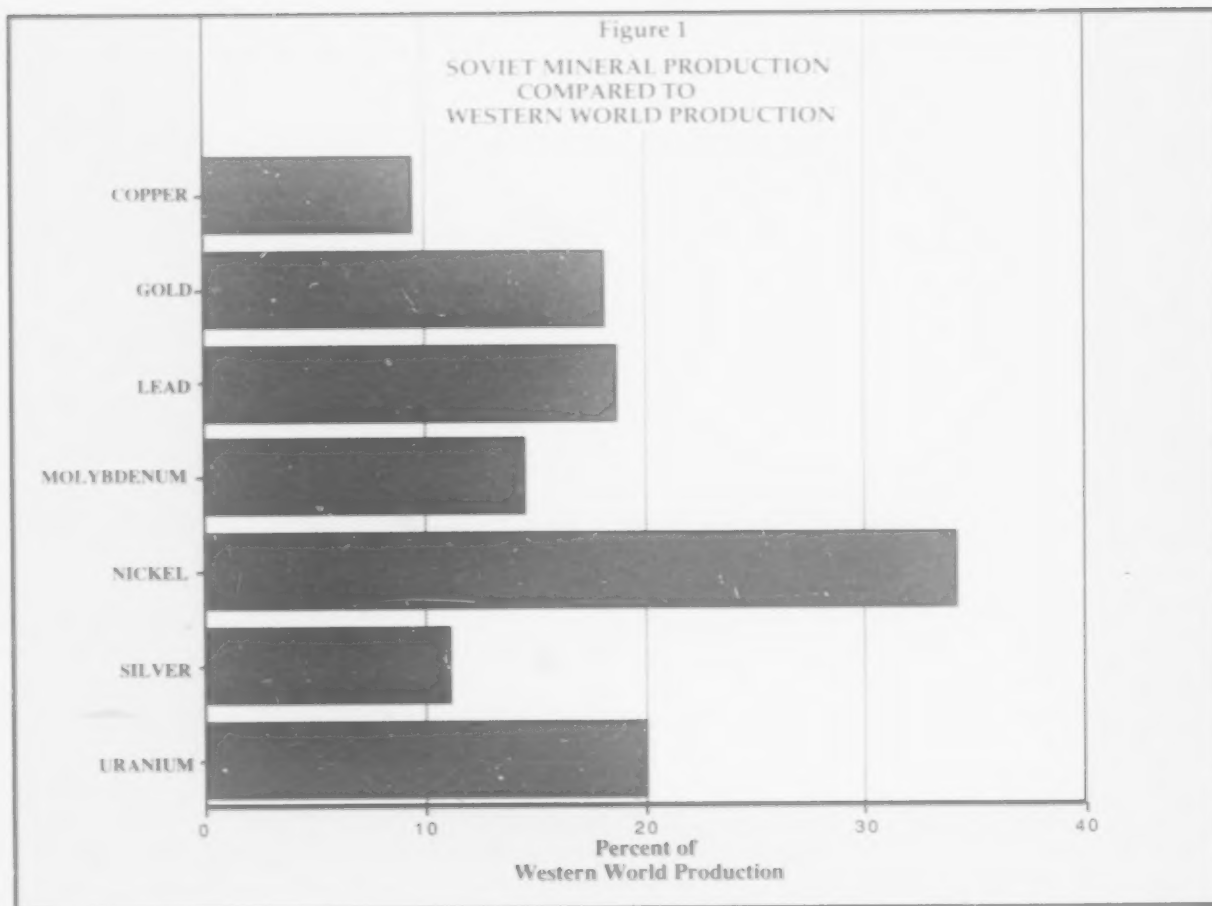
Eastern Europe is rich in natural resources. The Soviet Union, for example, in addition to being the world's largest producer of steel and oil, also produces a substantial share of the world's copper, gold, lead, molybdenum, nickel, silver, and uranium (Figure 1). Since the mining industry has excess capacity and products that meet western standards, mineral production is an industrial sector that could be expanded rapidly. Mining industry products are well suited for East West trade because buyers have no major concerns over the kinds of products or their quality.

The large R & D organizations of the ministries have led to the development of some mining technology that, in certain areas, is superior to that in the West. For example,

since by-product and co-product operations are used extensively in many Soviet mining enterprises, the advanced process technology used in these areas represents an excellent opportunity for cooperation between Western firms and Eastern European companies.

Institutional Pressures

Both internal and external pressures are leading to the opening of markets in Eastern Europe. The mining industry of Eastern Europe has some major safety and environmental problems. These problems have led to pressure on industry leaders to acquire technology from the West in order to mitigate the environmental impact of mining.



ANALYSIS AND COMMENTARY

Additionally, Comecon (Council for Mutual Economic Assistance) is weakening. Its system of reconciliation for payment is faltering, and trading relationships are being realigned. This presents an opportunity to establish new trading relationships, and to enter previously unopened markets.

The emphasis of Eastern European governments' market activities is changing as well. Industrial development will no longer be the primary focus. The Communist Party has been weakened, and new leaders are expected to shift priorities from heavy industry to consumer goods. However, hard currency is required to purchase the desired consumer goods as well as the equipment to manufacture these goods; therefore, export opportunities within large, established industries, such as mining, will be pursued earnestly by Eastern European nations in order to earn hard currency.

Challenges to Trade

Payment terms present an important challenge in trade arrangements involving Eastern European countries and the Soviet Union. It is relatively easy to get general agreements for cooperation, but difficult to get firm contracts, and very difficult to get paid in hard currency. However, there are many ways to collect payment. Often barter is the least difficult. Barter works best with non-manufactured goods (such as minerals, metals, and fuels) and other products which are fungible worldwide. Barter payment can take different forms, such as countertrade (Pepsi-Cola for Stolichnaya Vodka), or non-cash form (payment with oil or gold). Such items as consumer goods or specialized equipment, which vary significantly from those found in the West, are not as well suited to barter.

The lack of hard currency is the major obstacle. However, the Soviet Union has announced plans to make the Ruble fully convertible by the year 2000. In the meantime, hard currency is dedicated to high-priority items, because of the difficulty Eastern European nations have in obtaining convertible monies. Foreign exchange auctions have already been held, and may occur more frequently in the future to help facilitate trade.

Opportunities

Eastern Europe, and particularly the Soviet Union, offers many opportunities for the mining industry. Western purchases from these countries could include: fungible products (minerals, metals, and fuels); equipment such as heavy machinery; process technology; and new materials.

Opportunities to sell mining-related equipment abound. Items such as automation equipment (machine tools, industrial controls, electronics, diagnostics, communication equipment), process technology, and safety equipment would all be anxiously sought by Eastern European mining companies.

Eastern Europe represents an enormous potential market. But these countries must be able to sell products abroad in order to purchase from abroad. While Eastern European sales to the West may affect some small sectors of the mining industry in the short term, the large net gain in demand due to the opening of these markets will dramatically help the mining industry worldwide. By purchasing products and equipment from Eastern Europe, Western companies can benefit by gaining access to the largest untapped market in the world.

Conclusion

To the mining industry, *perestroika* will mean international restructuring. Although the evolution in the Soviet Union and the rest of Eastern Europe economies has only begun, the shift in the world supply/demand balance in most metals and minerals is forever changed. Despite some Western concerns about the current influx of large quantities of low-priced goods and commodities such as uranium, the long-term increase in world demand for minerals and fuels resulting from *perestroika* will more than offset any short-term disadvantages. As mining industry participants develop marketing strategies for the 1990s, they will need to consider Eastern European countries. The companies that are able to adapt to these changes will have a distinct advantage in the next decade. ■

TECHNICAL ANALYSIS IN SHORT-TERM URANIUM PRICE FORECASTING

Introduction

As market participants anticipate the end of the current uranium price decline and its subsequent reversal, increased attention will be focused upon forecasting future price movements. Although uranium is economically similar to other mineral commodities, it is questionable whether methodologies used to forecast price movements of such commodities may be successfully applied to uranium.

Technical Analysis

Technical analysis is a method of studying a market independent of the fundamental economic factors that affect the supply and demand for a given commodity. The technical analyst (technician) utilizes only three sets of data: price, volume, and open interest (the total purchase or sale commitments outstanding). The technical approach to commodities trading is based upon the assumption that consecutive prices are related and, as a result, past price movements set the course for future price trends. The technician believes that market fluctuations are non-random and predictable, and that impending price movements can be determined through the study of past market activity. Technical analysis methodologies fall into four broad categories: Patterns and Price Charts; Trend-Following Methods; Character-of-Market Analysis; and Structural Theories.

Patterns and Price Charts

This technique relies upon the charting of price movements in an effort to reveal repetitive patterns. It theorizes that the comparison of developing patterns with those of the past will indicate the direction of future price movements.

Trend-Following Methods

This trading strategy is based upon the principle of buying strength and selling weakness. That is, once a price trend

is established, it is more likely to continue than to reverse. Using this method, technicians follow moving averages of prices and construct swing charts which plot price movements of a minimum amount.

Character-of-Market Analysis

This methodology utilizes statistical measurements which are independent of absolute price levels. Through the development of oscillators, technicians follow price changes, rather than price levels. The technician also analyzes trading volume and open interest.

Structural Theories

This grouping includes the analysis of seasonal trends. This widely-respected method studies historical performance to reveal broad cyclical patterns of price movements. The use of this method is largely confined to grains, livestock, and other commodities that exhibit seasonal growing and harvesting patterns. Long-term time cycles are also followed by these technicians, and followers of the once-popular Elliott wave theory fall into this group as well.

To the extent that the uranium market is inefficient, technical analysis may provide some indication of future uranium price movements.

Technical Analysis and the Efficient Market Theory

Technical analysis is not totally supported by the efficient market theory, a hypothesis widely used by economists to describe price movements in organized markets. According to this theory, all relevant information is reflected in a commodity's price. This would include the fundamental economic factors of supply and demand as well as market expectations. With this point the technician would agree. However, the theory does not support the technician's view that price movements are non-random. The efficient market theory proposes that prices will respond only to new information or to surprises. Because new information is by nature unpredictable, the theory advances that future prices will move in a random fashion. If true, this "random walk" will doom short-term price forecasting at the outset.

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Because technicians do not believe that price movements are random, they rely upon repeatable price patterns as a basis for forecasting future price movements. The four categories of technical analysis outlined above are not necessarily mutually exclusive. In almost all cases, technicians utilize price charts in order to follow the absolute level of the market. In addition, technicians will supplement their analysis with other statistical measures of market activity such as oscillators or broader measures of price trends or cycles.

In the technical analysis methodology which utilizes patterns and price charts, analysts develop charts of past prices in order to reveal patterns and configurations that have historically preceded certain price movements. The appearance of these patterns is considered a signal that a similar movement is about to occur. Individuals who believe in the technical approach feel that price is the best indicator of the current market situation, and that fundamental economic factors may ignore expectations and are subject to individual interpretation and delays in data collection.

Indicators of Major Bottoms

One of the most important decisions a trader has to make is the determination of a major top in a rising market or a major bottom in a declining market. To the technician, three of the more common and reliable patterns used in forecasting impending market rallies are:

- inverted head-and-shoulders;
- double bottom;
- rounded bottom.

Technical analysts recognize the head-and-shoulders formation as one of the most reliable patterns indicating a major reversal in the direction of the market (Figure 1). The development of this pattern consists of four distinct phases: development of the left shoulder, development of the head, development of the right shoulder, and movement beyond the neckline. The head-and-shoulders formation is not complete until the neckline has been passed. According to some theorists, the extent of price movement beyond the neckline will be determined by the distance between the top of the head and the neckline.

Another indicator of a major market break is a double bottom (Figure 2). Although it occurs with less frequency

Figure 1
INVERTED HEAD-AND-SHOULDERS

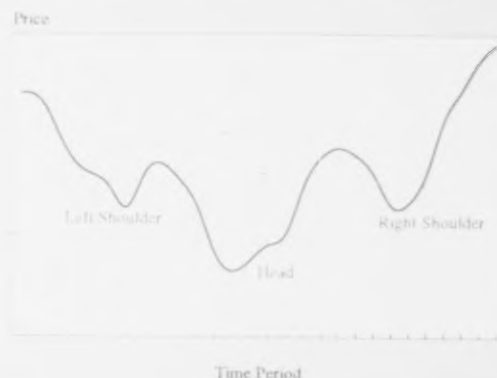


Figure 2
DOUBLE BOTTOM

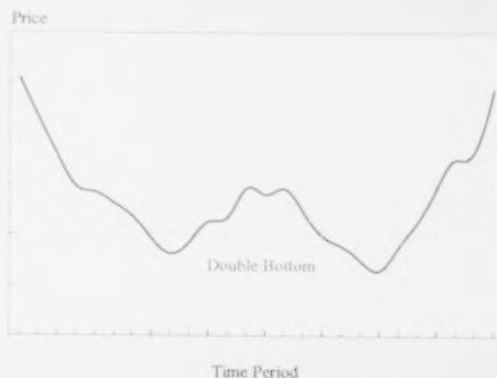
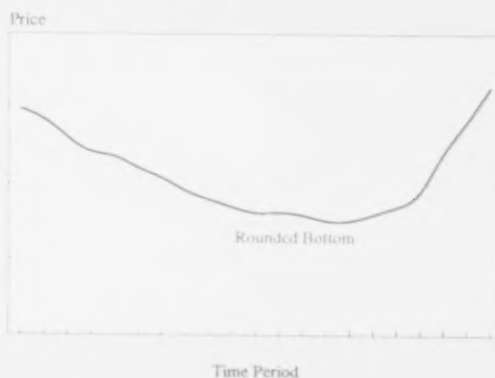


Figure 3
ROUNDED BOTTOM



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than other patterns, it is thought to signal the end of a major market trend. The formation normally develops fairly rapidly and is believed to indicate that a major rally is about to occur.

Technical analysts also believe that rounded tops and rounded bottoms are reliable indicators of changing price trends (Figure 3). As this pattern develops, the size of the "saucer" is interpreted as a signal of the extent to which prices will advance or decline. In addition, a "platform" may develop as a forerunner of the main break or rally.

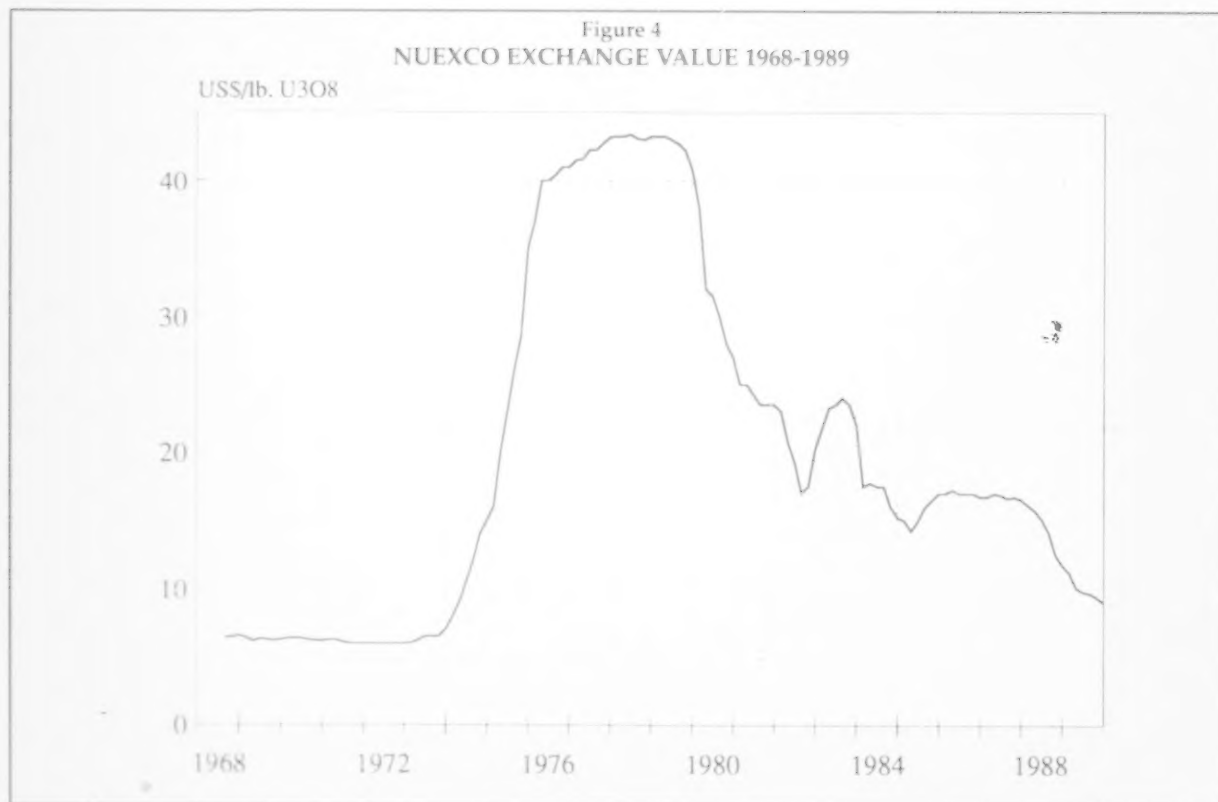
Applying Technical Analysis to Uranium Prices

For commodities in which futures contracts are traded, technical analysis can yield useful information regarding future price movements. Unfortunately, the price trends which develop are often short-lived, and because so many market participants are familiar with the technical patterns, their collective trading activities create a self-fulfilling prophecy as waves of buying and selling are created in

response to "bullish" or "bearish" patterns. This cumulative action itself creates unanticipated price movements which may destroy the validity of the analysis as prices move higher or lower than anticipated. In the resultant overbought or oversold market, prices very often rapidly reverse direction as traders attempt to capture their profits.

Technical analysis is most often applied to those commodities in which fundamental economic information is widely dispersed and consequently difficult to accumulate (largely grains and livestock) and which is frequently subject to substantial revision. In the uranium industry, however, sources of supply and demand are readily identified, problems of substitution do not exist, except in the most long-term forecasts, and there is comparatively little delay in obtaining accurate data. As a result, most significant market information is readily available and known.

When examining past uranium prices (Figure 4), it is difficult to identify any of the patterns discussed above or



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to discern any repeatable trends. This is at least partially due to the relatively few (when compared to other commodities) data points which exist. The patterns displayed in **Figures 1** through **3** can develop in as little as four weeks if prices are generated daily. When prices are generated on a monthly basis, the same patterns would take up to two years to fully develop.

Although it would appear that a fundamental approach to uranium price forecasting should yield the most accurate results, perhaps technical analysis should not be completely discounted. The commercial nuclear fuel market is less than 25 years old. Originally, it was highly inefficient and information was not widely available. Compared to commodity futures markets, it is still inefficient, even though increased trading activity has enhanced the exchange of information among market participants. Because the market is still inefficient, technical analysis may provide some indication of future uranium price movements.

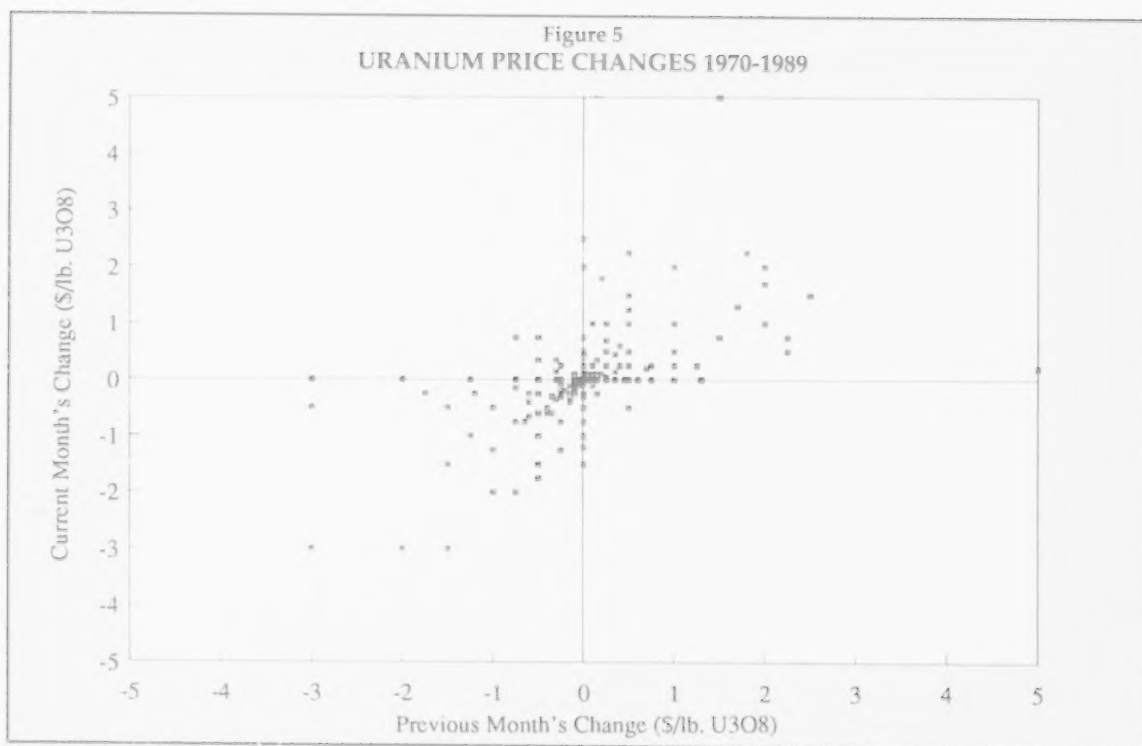
According to the efficient market theory, a truly efficient market should yield purely random price movements. As evidenced in **Figure 5**, uranium price movements have not

been purely random events. This graph plots one month's price change against that of the previous month for the period 1970 through 1989. If uranium price movements were purely random, the points would be scattered equally among the four quadrants. The pattern of positive autocorrelation seen in this graph suggests that price changes in one period are most often followed by a change in the same direction in the next period. This dependency runs contrary to the efficient market theory and may, to some extent, support the use of technical analysis in uranium price forecasting.

Conclusion

Technical analysis of price movements, as applied to other commodities, cannot be directly applied to uranium. This is largely due to the relatively small field of uranium price data points from which patterns would need to be identified. However, due to the high degree of positive autocorrelation present in uranium price movements, some form of technical analysis may yield insight into impending uranium price movements.

David S. Schramm



MAJOR ISSUES FACING RESEARCH REACTOR OPERATORS

Introduction

As of May 1989, 325 research reactors operated in over 50 countries (Table 1). Research reactors of many different sizes and configurations are used for:

- medical and nuclear research, including isotope production;
- materials testing;
- personnel training;
- prototype design work;
- electricity production.

Steady-state power levels range from as little as one kilowatt in certain reactors in Switzerland, Czechoslovakia, France, the United Kingdom (UK), Japan, and the USA, to as much as 563,000 kilowatts in the sodium fast reactor (Phenix) located in France. Enriched uranium in research reactors typically varies from 19.75 weight-percent (w/o) U²³⁵ to 93.15 w/o U²³⁵.

Fuel Supply Situation

The most pressing issue facing research reactor operators today is the uncertainty of uranium metal and oxide availability for use in fuel fabrication. Most of the enriched uranium for research reactors outside Eastern Europe and the Soviet Union comes from US Department of Energy (DOE) enrichment facilities and laboratories. DOE now produces enriched uranium only in the form of uranium hexafluoride, but the practice among fabricators of research reactor fuel is to require enriched uranium in metal or oxide form. This has not caused a problem in the past, because the US Atomic Energy Commission (AEC), the forerunner of DOE, produced a vast stockpile of uranium metal in 1964, which could be converted to uranium oxide when necessary.

Table 1
RESEARCH REACTORS IN OPERATION
(as of May 1989)

Location	Number
North America	113
Western Europe	90
Eastern Europe	44
Japan/Australia	20
Asia	31
Latin America	18
Africa and Middle East	9
Total	325

Source: International Atomic Energy Agency Research reactor database

For the past 25 years, this stockpile, and material recovered and recycled from it, has been sufficient to meet research reactor needs as well as those of the US Department of Defense. In June 1989, however, DOE announced that the diminishing stockpile would henceforth be reserved for Defense Department uses. This essentially prevented the filling of new orders of uranium metal or oxide for research reactors until DOE could begin producing uranium metal and oxide at a refurbished conversion facility at the Y-12 facilities in Oak Ridge, Tennessee. Originally scheduled for operation in the summer of 1990, this conversion facility is now scheduled to commence production in the spring of 1991. In the meantime, the lack of a current commercial source of supply for metal and oxide has the potential to hamper some research reactor operations.

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Reduced Enrichment Levels

An area of major achievement in the last 10 to 12 years in research reactor fuel design has been the reduction of average enrichment levels. Most research reactors were designed to use high-enriched uranium (about 93 w/o U-235) in order to produce radiation levels necessary for appropriate research and testing.

During the 1970s, concerns over the possible illegal diversion of high-enriched uranium for use as weapons prompted DOE to assign Argonne National Laboratory (ANL) the lead in developing a program to reduce research reactor enrichments below 20 w/o U-235 without reducing research capabilities. Since the formation of the Reduced Enrichment Research and Test Reactor Program (RERTR) in 1978, ANL, in cooperation with major western-world research fuel fabricators—Atomic Energy of Canada Limited (AECL), Babcock & Wilcox, Compagnie pour l'Etude et la Réalisation de Combustibles Atomiques (CERCA), General Atomics, NUKEM, and the United Kingdom Atomic Energy Authority (UKAEA)—has developed, tested, and qualified new low-enriched fuels technically capable of replacing high-enriched fuel in about 80 to 90 percent of the world's research reactors.

Additional technical work remains in order to qualify advanced fuel designs capable of displacing certain high-enriched fuel designs. These advanced fuel designs would reduce the amount of high-enriched fuel exported by the USA by an average of about 150 kilograms each year. It is uncertain, however, whether the US government will provide adequate funding for the additional work needed through 1993. Currently, the budget now before Congress does not provide for RERTR funding after FY 1990. Without additional assistance in developing a qualified design, five non-US reactors will be unable to convert to the use of reduced enrichments, and consequently will still need to acquire high-enriched fuel from some source.

Reprocessing

Reprocessing is also an area of concern, due to its integral role in the fuel cycle (**Figure 1**). Spent fuel elements are shipped to a DOE reprocessing facility (usually Savannah River) under a reprocessing contract. The research reactor operator typically receives 98 to 99 percent of the equivalent natural uranium and separative work contained in the spent fuel in the form of fuel credits against future enriched uranium orders.

DOE research reactor agreements originally provided for the receipt and financial settlement of returned US-origin spent fuel. This policy was scheduled to be extended by ten years as of December 31, 1988. This did not occur, however. In a notice to customers dated October 2, 1989, DOE stated:

"It has been determined that this policy cannot be extended until the requirements of the National Environmental Policy Act have been met. The Department is currently preparing an Environmental Assessment (EA) on the receipt of these fuels. In addition, due to current litigation on this policy, the Office of General Counsel has recommended that the EA be made available for public review and comment. This will involve publication in the Federal Register with a minimum of a 30-day comments period."

Assuming no major comments or revisions to the EA, DOE concluded that the policy could not be renewed before the end of calendar year 1989. To date, DOE has not even published the EA, and there seems to be no timetable for the EA or a target date for policy renewal. In

ANALYSIS AND COMMENTARY

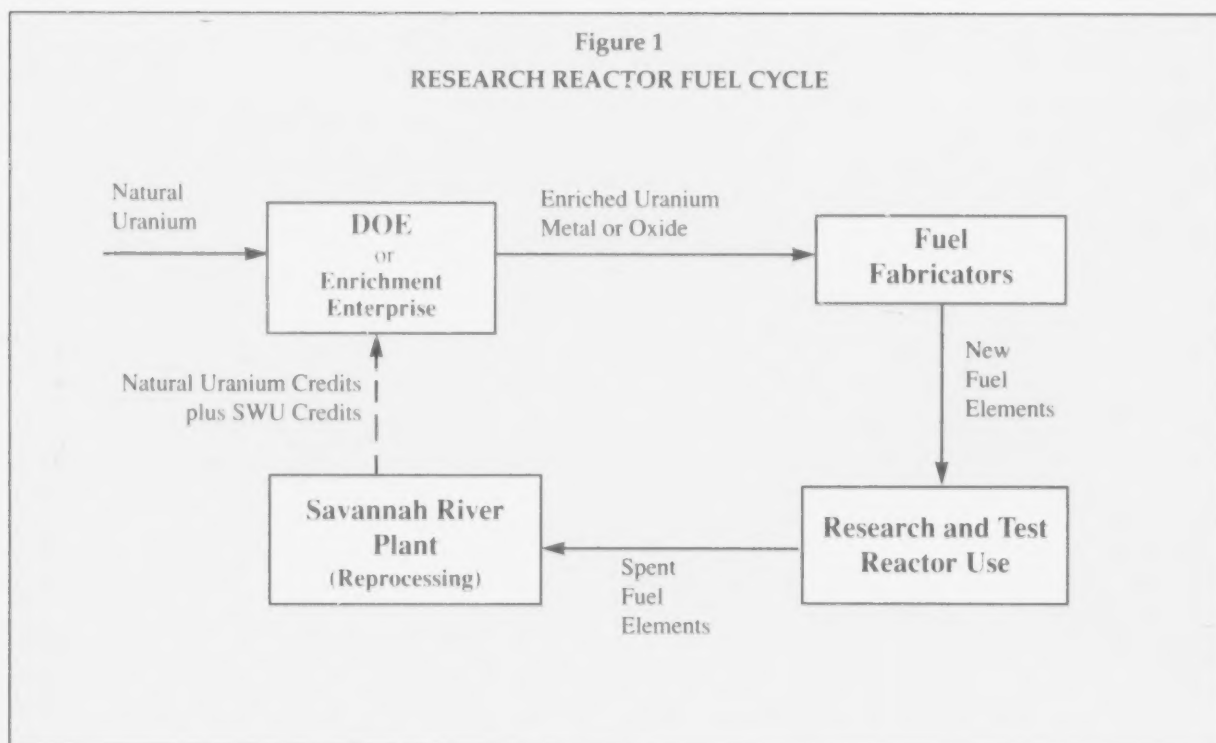
the meantime, high-enriched spent fuel has begun to accumulate at reactor sites worldwide. Although on-site storage capacities, in general, appear to be sufficient to accommodate this temporary disruption in reprocessing, the fuel storage areas of some Australian research reactors are essentially filled to capacity. Thus, unless this problem is resolved reasonably soon, lack of storage capacity could begin to limit research reactor operations worldwide.

Conclusion

At present, research reactors can continue functioning unabated. However, unless these serious problems are resolved soon, several research reactors could have to temporarily cease operations. Additionally, research reactor operators may soon need to seek new sources for high-enriched fuel, as well as new storage facilities for spent fuel.

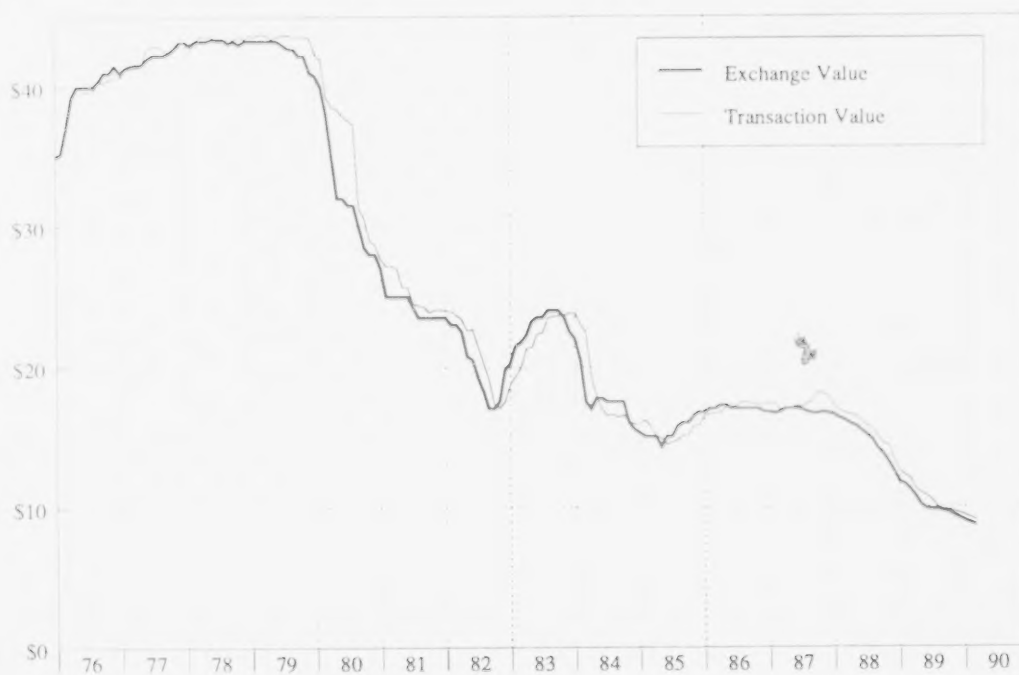
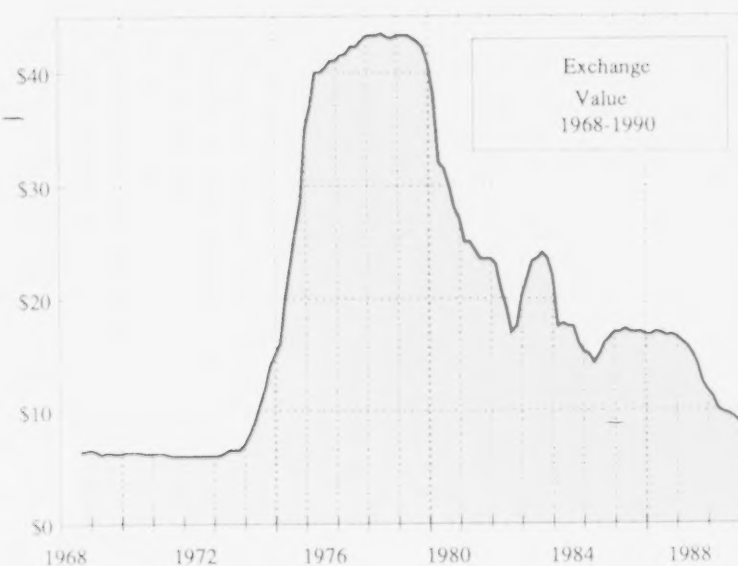
R. Lee Clanton, Jr.

Figure 1
RESEARCH REACTOR FUEL CYCLE



HISTORICAL MARKET DATA

**NUEXCO Historical
Exchange and
Transaction Values**
(In US Dollars/Pound U_sO₂)



HISTORICAL MARKET DATA

HISTORICAL MARKET VALUES

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (\$US/lb U₃O₈)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85	8.70										

HISTORICAL US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated (\$US/lb U₃O₈)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	None	

HISTORICAL MARKET DATA

HISTORICAL UF₆ VALUES Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90	25.25										

HISTORICAL US UF₆ PREMIUM (Relative to the UF₆ Value) Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	None	

HISTORICAL TRANSACTION VALUES Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25	9.05										

HISTORICAL MARKET DATA

HISTORICAL LOAN RATES

Determined as of the last day of the month indicated (Percent per Annum)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50	3.50										

* Float with Prime Rate

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (\$US/lb U as UF6)

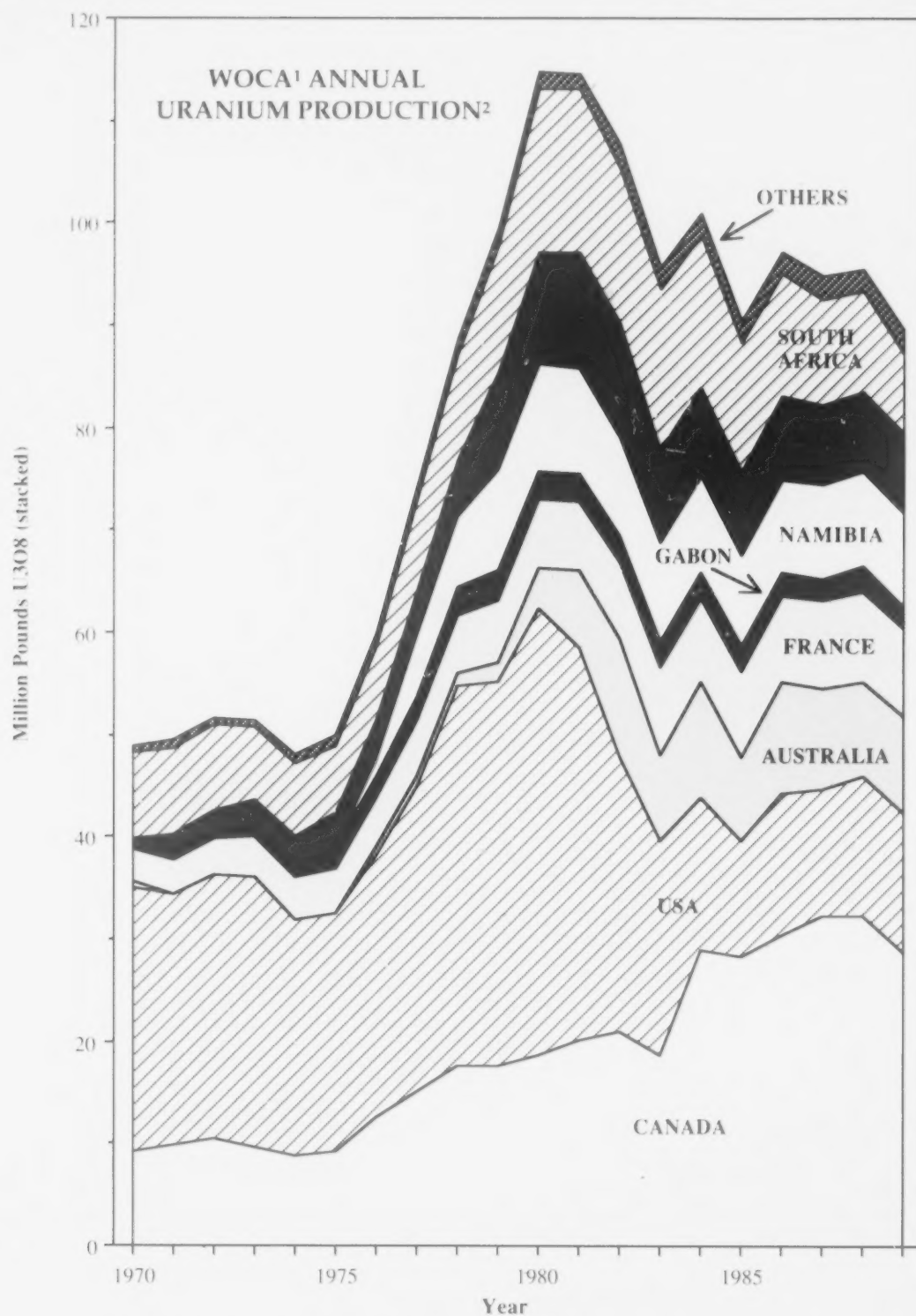
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.50	1.50										

HISTORICAL SWU VALUES

Determined as of the last day of the month indicated (\$US per SWU)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54	50										

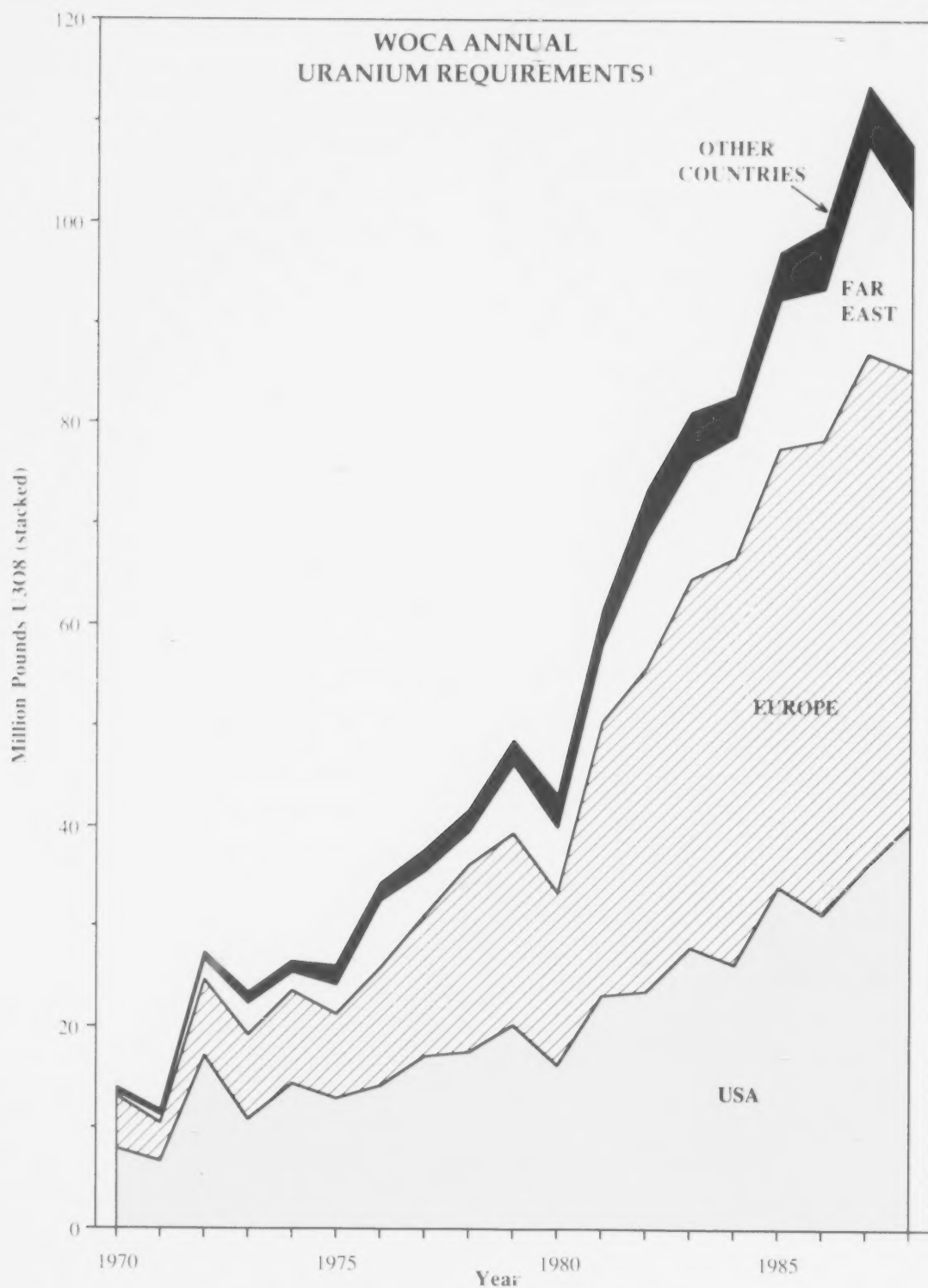
HISTORICAL MARKET DATA



¹ WOCA = World Outside of Centrally-Planned Economic Areas.

² Estimated world production in 1989 totalled 89.6 million pounds (Australia—9.5; Canada—28.7; France—8.5; Gabon—2.2; Namibia—9.2; Niger—7.7; South Africa—7.7; USA—13.7; Other—2.3).

HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual plant completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

—GOVERNMENT STATISTICS

GOVERNMENT STATISTICS

AUSTRALIA

		Consumer Price Index ¹ (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ² (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia (Australian dollars) ⁶	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates ³ (June 1985=100)
1980	Avg.	95.8	83.1	—	140.8 ^s
1981	Avg.	105.0	85.9	—	154.1 ^s
1982	Avg.	116.7	89.0	—	174.9 ^s
1983	Avg.	128.5	96.9	—	181.9 ^s
1984	Avg.	133.6	98.0	—	194.4 ^s
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
Jan	1989	—	110.6	—	122.2
Feb	1989	—	111.2	521.90	122.2
Mar	1989	188.0R	114.9	—	123.1
Apr	1989	—	117.5	—	123.2
May	1989	—	118.6	530.40R	123.7
June	1989	192.6R	119.9	—	124.7
July	1989	—	120.1	—	126.2R
Aug	1989	—	119.2	539.30	126.2R
Sept	1989	197.0R	117.7	—	126.3R
Oct	1989	—	117.8	—	126.5R
Nov	1989	—	118.0	—	126.8R
Dec	1989	—	—	—	126.8

P = Preliminary R = Revised since last month

¹Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 = 100.0). Figures shown at end of quarter represent quarterly average.

²Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

³Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

⁴Monthly data for the period 1967 to 1986 appear in Report 233.

⁵Base: June 1976 = 100.

⁶Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

GOVERNMENT STATISTICS

CANADA

Wage-earner Data:
Average Hourly Earnings (C\$)²

		Industrial Products Price Index: All Commodities ¹ (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells ³ (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	138.2	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	143.8	20.91	18.51	16.95	13.17	13.77
Jan	1989	130.7	146.8	21.22	19.45	18.14	13.75	13.82
Feb	1989	130.8	147.8	22.05	19.51	18.26	13.79	13.89
Mar	1989	131.3	148.5	21.90	19.65	18.35	13.62	14.10
Apr	1989	131.3	149.0	22.37	19.80	18.40	13.57	14.16
May	1989	131.4	150.5	21.89	20.02	18.17	13.76	14.27
June	1989	131.5	151.3	21.89	20.02	18.17	13.76	13.22
July	1989	131.4	152.3	21.67	19.60	17.96	13.57	12.98
Aug	1989	131.3	152.4	20.97	19.76	18.24	13.52	14.30
Sept	1989	131.0	152.6	21.97	20.61	18.73	13.68	14.83
Oct	1989	130.8	153.2	22.26	20.71	18.74	13.99	14.77
Nov	1989	130.6	153.7	22.60	20.64R	18.78R	13.93	14.75R
Dec	1989	130.2	153.6	22.80P	20.47P	18.90P	13.66P	15.01P
Jan	1990	—	154.9	—	—	—	—	—

P = Preliminary R = Revised since last month

¹Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

²Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

³Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand) ¹	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100) ²	Consumer Price Index ³ (1985 = 100)	Production Price Index All Groups ⁴ (1985 = 100)	Total Employment in Mining and Quarrying ⁵	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) ⁵
1980	Avg.	35.53	—	51.9	55.2	709,042	2,237,689
1981	Avg.	41.89	—	59.8	62.7	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	71.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	79.0	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	85.6	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	100.0	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	119.5	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	136.2	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	154.1	705,355	7,774,054
Jan	1989	—	—	166.8	165.5	714,593	704,320
Feb	1989	—	—	168.2	168.5	696,329	669,983
Mar	1989	112.29	262.8	170.9	171.1	702,746	695,843
Apr	1989	—	—	173.1	173.8	658,677	634,344
May	1989	—	—	175.9	176.4	706,056	721,263
June	1989	113.76	267.0	177.7	177.1	706,810	720,586
July	1989	—	—	179.3	178.8	711,648	775,002
Aug	1989	—	—	181.8	180.7	703,812	793,475
Sept	1989	119.76	280.2	183.4	181.7	—	—
Oct	1989	—	—	185.1	183.9	—	—
Nov	1989	—	—	187.0	185.6	—	—
Dec	1989	120.79	282.0	189.4	187.2	—	—
Jan	1990	—	—	192.0	—	—	—

P = Preliminary R = Revised since last month

¹Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

²Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

³Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 236.

⁴Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

⁵Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

GOVERNMENT STATISTICS

UNITED STATES									
		Producer Price Index ¹		Consumer Price Index ²		GNP Implicit Price Deflator ³		Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴	
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)		(1982 = 100)		Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)
								Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
Jan	1989	109.4	110.5	121.1	—	13.80	13.49	12.85	10.27
Feb	1989	110.1	110.8	121.6	—	13.66	13.48	12.88	10.26
Mar	1989	110.5	111.5	122.3	125.4	13.71	13.51	12.91	10.30
Apr	1989	111.8	112.3	123.1	—	13.68	13.65	12.92	10.31
May	1989	112.1	113.2	123.8	—	13.60	13.57	12.98	10.33
June	1989	112.4	112.9	124.1	126.0	13.62	13.66	12.98	10.37
July	1989	112.2	112.8	124.4	—	13.70	13.75	13.12	10.41
Aug	1989	111.4	112.0	124.6	—	13.64	13.72	13.08	10.40
Sept	1989	111.9	112.4R	125.0	126.8	13.70	13.99	13.18	10.47
Oct	1989	112.4	112.7	125.6	—	13.76	13.94	13.25	10.43
Nov	1989	112.2	112.7	125.9	—	13.69R	14.12	13.26	10.47
Dec	1989	112.3	113.0	126.1	128.0	13.53P	13.99P	13.31R	10.52
Jan	1990	114.2	114.9	127.4	—	—	—	13.40P	10.46P

P = Preliminary R = Revised since last month

¹US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

²US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

³US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

⁴US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

GOVERNMENT STATISTICS

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	\$16.10	3.6	n/a	1.2
1977	29.9	27.8	\$19.75	5.6	n/a	4.0
1978	37.0	31.6	\$21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agents

³ Includes imports by domestic utilities and domestic suppliers

GOVERNMENT STATISTICS

**VOLUME AND PRICE OF URANIUM DELIVERIES
TO THE EUROPEAN COMMUNITY¹**
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC ² (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ^{3,4}		Spot Contracts ^{3,4}	
			Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈	Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,500	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65R	\$16.13R

R = Revised

¹The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

²The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

⁴Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

CALNDAR

Nuclear Industry Calendar

1990

- Mar. 12-15 *Radioactive Material Transportation Basic Workshop* (Oak Ridge, Tennessee). Contact Teresa Yearwood at 1-615-482-9031.
- Mar. 25-28 *Fuel Cycle '90 Conference* (Opryland Hotel, Nashville, Tennessee), sponsored by the US Council for Energy Awareness. Contact the USCEA Conference Office at 1-202-293-0770.
- Apr. 8-12 *First Annual International High-Level Radioactive Waste Management Conference* (Caesar's Palace Hotel, Las Vegas, Nevada), sponsored by the American Nuclear Society and American Society of Civil Engineers. Contact the ANS at Meetings Department at 1-312-352-6611.
- Apr. 9-11 *23rd JAIF Annual Conference* (Kyoto, Japan). Contact Ms. Sachie Sugoh, Dept. of Planning and International Affairs, JAIF, at 03-508-9056.
- Apr. 22-25 *INFO '90* (Westin Hotel, Dallas, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.
- Apr. 23-27 *1st Regional Seminar for the Middle East and Europe on Management of Quality for Nuclear Power Projects* (Prague, Czechoslovakia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400, Vienna, Austria.
- May 15-17 *Annual Meeting on Nuclear Technology 90* (Nuremberg, FR Germany). Contact Deutsches Atomforum e.V., Conference Office JK 90 at 0228 507223.
- June 3-7 *30th Annual Conference of the Canadian Nuclear Association and 11th Annual Conference of the Canadian Nuclear Society* (Toronto, Canada). Contact Canadian Nuclear Association, 111 Elizabeth Street, Toronto, Ontario, Canada M5G 1P7.
- June 4-8 *International Symposium on Nuclear Techniques in Exploration and Exploitation of Energy and Mineral Resources* (Moscow, USSR). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.
- Sept. 4-7 *International Seminar on the Costs and Financing of Nuclear Power in Developing Countries* (Jakarta, Indonesia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.
- Sept. 5-7 *Uranium Institute 15th Annual Symposium* (London, United Kingdom). Contact the UI at 44-1-225-0308.
- Sept. 16-19 *Uranium Seminar '90* (Hyatt Regency, San Antonio, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.
- Nov. 11-14 *Nuclear Energy Forum* (Washington Hilton, Washington, D.C.), sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611.

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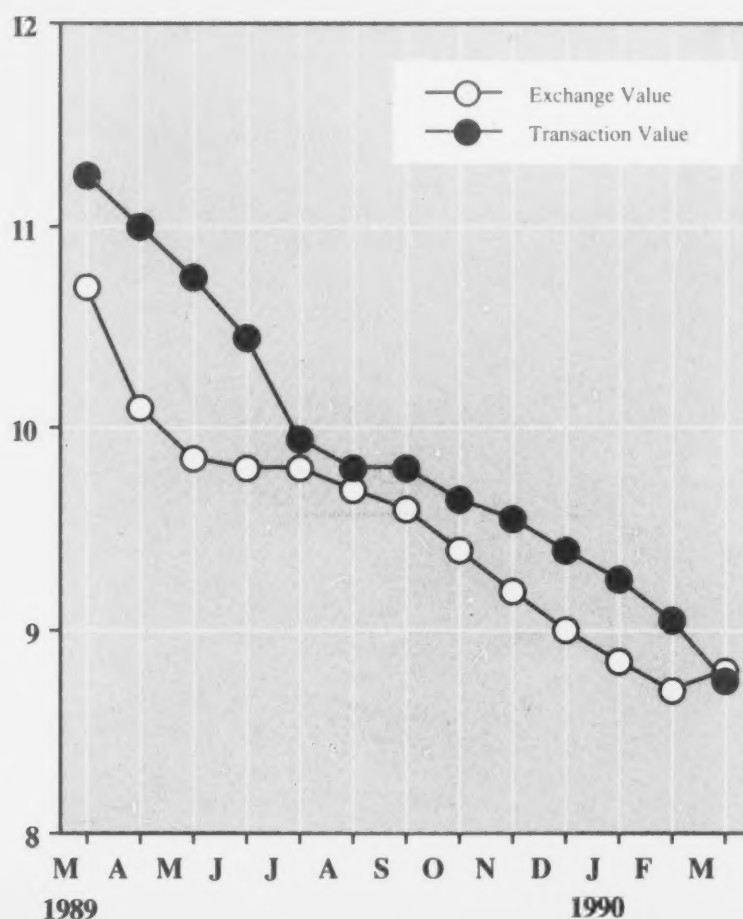
NUEXCO

Monthly Report

April 1990

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NUEXCO MONTHLY REPORT

April 1990, No. 260

* * *

EXECUTIVE SUMMARY

(As of March 31, 1990)

Exchange Value
\$8.80, up \$0.10

The **Exchange Value** is \$8.80 per pound U₃O₈, up \$0.10 from February 28.

UF₆ Value
\$24.40, down \$0.85

The **UF₆ Value** is \$24.40 per kg U as UF₆, an \$0.85 decrease from the February 28 UF₆ Value.

**Uranium Sales;
Supply and
Demand**

Eight March **uranium** sales involved **5.2 million** pounds equivalent U₃O₈. Three of these sales involved spot or near-term delivery and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **3.8 million** pounds equivalent U₃O₈, down from 5.1 million pounds at the end of February. Active spot and near-term **uranium demand** totals **4.5 million** pounds, up from 3.7 million pounds on February 28. The spot and near-term **supply-demand ratio** is **0.9 to 1**, down from the February 28 figure of 1.4 to 1.

Transaction Value
\$8.75, down \$0.30

The **Transaction Value** is \$8.75 per pound U₃O₈, down \$0.30 from February 28. The calculation includes 13 transactions over a period of three months involving a total of 4.4 million pounds equivalent U₃O₈.

Loan Rate
3.5%, unchanged

The **Loan Rate** is **3.5 percent** per annum, unchanged for the past 29 months. Five natural uranium loans are reported involving over 1.6 million pounds equivalent U₃O₈.

Conversion Value
\$1.45, down \$0.05

The **Conversion Value** is \$1.45 per pound U as UF₆, down \$0.05 from February 28. Two transactions for conversion services are reported.

SWU Value
\$50, unchanged

The **SWU Value** remained at \$50 per SWU. Six SWU sales are reported. Active supply is down from 415 to 345 thousand SWU, and active demand dropped from 265 to 95 thousand SWU.

* * *

**The Long And The
Short Of It**

George White, Jr., in his speech before the USCEA Fuel Cycle '90 Conference on March 26, reminded the audience that the current state of affairs in the uranium market is the inevitable economic result of past excesses, primarily the buildup of huge inventories during the late 1970s and early 1980s.

**Liability in Shipping
Radioactive Materials**

For more than forty years, and to the credit of the nuclear industry, accidents in shipping radioactive materials have been rare. Nevertheless, any party remotely connected with a shipment that results in a serious accident is potentially liable. Robert L. Bovey, in his speech before the USCEA Fuel Cycle '90 Conference on March 26, discussed some of the questions that should be asked about radioactive material transportation liability insurance.

**South Korea's Nuclear
Fuel Industry**

South Korea's fuel fabrication plant began commercial operation in March, marking the culmination of the country's efforts, initiated in the mid-1970s, to develop self-sufficiency in nuclear fuel fabrication.

NUEXCO MONTHLY REPORT 260 FIGURES OF THE MONTH (March 31, 1990)	This Month (Report 260)	Last Month (Report 259)	12 Months Ago (Report 248)
Exchange Value (\$US per pound equivalent U ₃ O ₈)	8.80	8.70	10.70
UF₆ Value (\$US per kg U as UF ₆)	24.40	25.25	33.00
Transaction Value (\$US per pound equivalent U ₃ O ₈)	8.75	9.05	11.25
Loan Rate (Per Annum)	3.5%	3.5%	3.5%
Conversion Value (\$US per pound U as UF ₆)	1.45	1.50	1.95
Near-Term Uranium Supply ¹ (million pounds equivalent U ₃ O ₈)	3.8	5.1	3.8
Near-Term Uranium Demand ² (million pounds equivalent U ₃ O ₈)	4.5	3.7	1.1
Near-Term Supply-Demand Ratio	0.9	1.4	3.5
Recent Uranium Sales: ³			
Number of Transactions	8	17	19
Quantity of Material (Million pounds equivalent U ₃ O ₈)	5.2	15.1 ⁴	7.9
Nuexco SWU Value: (\$US per SWU)			
at 0.3 tails assay	50	50	67
US DOE SWU Prices: (\$US per SWU)			
USEC	117.85 ⁵	117.85 ⁵	117.00 ⁶
AFC	153.00 ⁷	153.00 ⁷	153.00 ⁷
Requirements	157.00 ⁷	157.00 ⁷	157.00 ⁷
Incentive Price (IP1)	90.00 ⁸	90.00 ⁸	90.00 ⁸
Market Value of Enriched UF₆ ⁹ : (\$US per kg U as UF ₆)			
2.5 w/o U ₂₃₅	267	266	343
3.0 w/o U ₂₃₅	343	342	441
3.5 w/o U ₂₃₅	421	420	542
4.0 w/o U ₂₃₅	500	498	644

¹ Active inquiries to sell, for delivery within 12 months measured from the date of this Report.

² Active inquiries to purchase, for delivery within 12 months measured from the date of this Report.

³ Uranium sales only; does not include loans, conversion, or SWU transactions.

⁴ Included 8 transactions concluded prior to February 1, 1990.

⁵ Effective 10/1/89 to 9/31/90.

⁶ Effective from 10/1/87 to 9/31/89.

⁷ Effective since 10/1/84.

⁸ Effective from 10/1/86 to 9/31/90, for up to 30% of annual requirements. DOE chose to waive application of the GNP deflator for FY87-FY90 deliveries.

⁹ Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

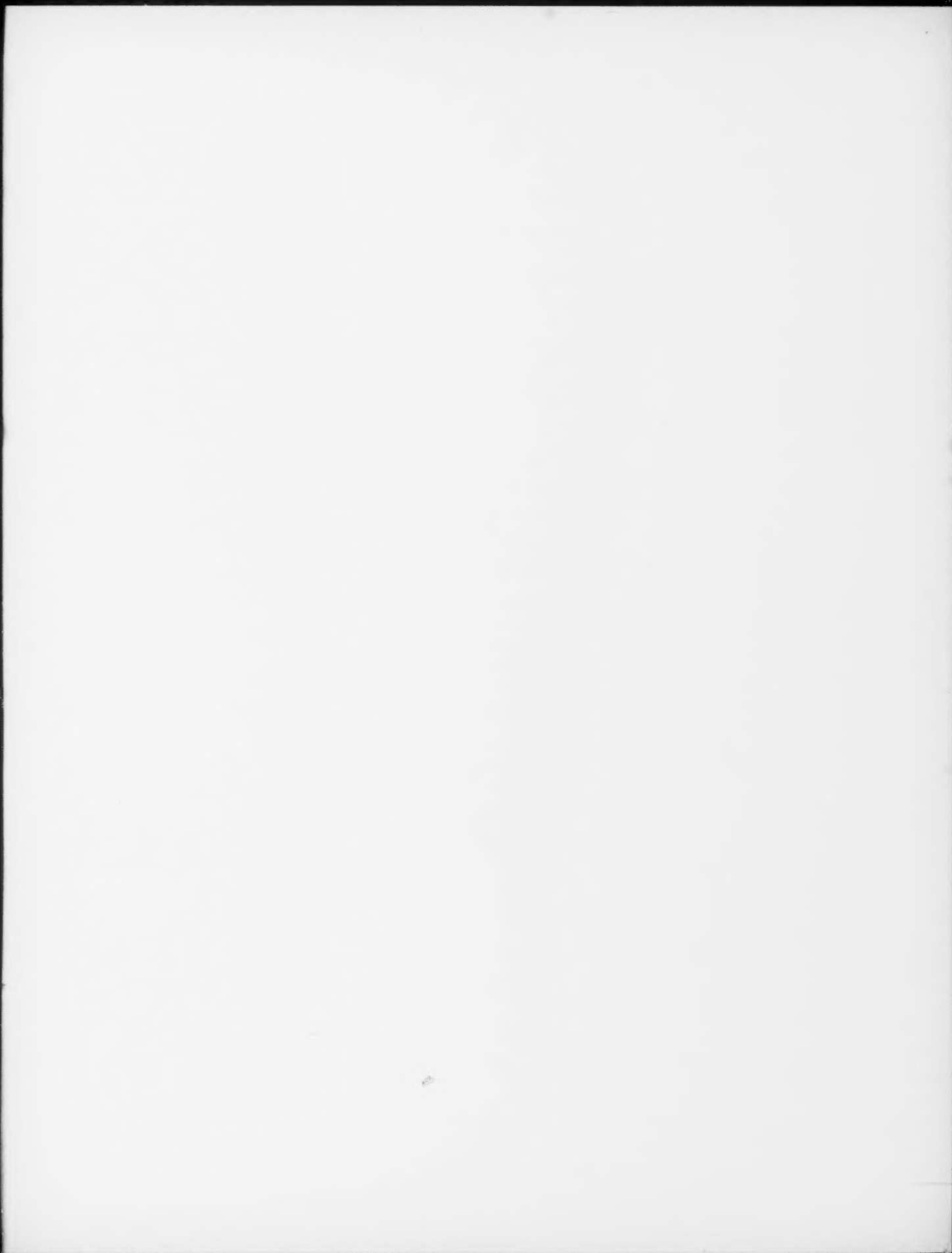
CURRENT MARKET DATA

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

EXCHANGE VALUE						
Country (currency)	per lb U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	11.47	11.58	14.07	29.82	30.10	36.58
Belgium (comm. franc)	306.01	313.27	427.64	795.57	814.44	1,112
Canada (dollar)	10.39	10.52	13.46	27.01	27.34	34.99
EEC (ecu)	7.19	7.28	9.78	18.68	18.94	25.43
Finland (markka)	34.51	35.49	47.82	89.73	92.26	124.33
France (franc)	49.69	51.14	69.39	129.19	132.96	180.41
Italy (lira)	10,860	11,204	15,032	28,234	29,128	39,079
Japan (yen)	1,293	1,286	1,418	3,362	3,343	3,687
Netherlands (guilder)	16.54	16.99	23.04	43.01	44.18	59.60
So. Africa (comm. rand)	22.21	22.55	27.78	57.73	58.62	72.22
Spain (peseta)	944.42	967.11	1,278	2,455	2,514	3,322
Sweden (krona)	53.08	54.90	70.26	138.00	142.73	182.67
Switzerland (franc)	12.91	13.31	17.39	33.55	34.60	45.22
UK (pound)	5.15	5.28	6.44	13.38	13.73	16.74
US (dollar)	8.70	8.85	11.20	22.62	23.01	29.12
West Germany (mark)	14.68	15.06	20.38	38.15	39.16	52.98

TRANSACTION VALUE						
Country (currency)	per lb U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	11.93	12.10	15.08	31.02	31.46	39.19
Belgium (comm. franc)	318.33	327.43	458.19	827.58	851.25	1,191
Canada (dollar)	10.81	10.99	14.42	28.09	28.58	37.49
EEC (ecu)	7.48	7.61	10.48	19.43	19.79	27.24
Finland (markka)	35.90	37.09	51.24	93.34	96.43	133.21
France (franc)	51.69	53.46	74.35	134.39	138.97	193.29
Italy (lira)	11,297	11,710	16,105	29,370	30,444	41,870
Japan (yen)	1,345	1,344	1,519	3,498	3,494	3,950
Netherlands (guilder)	17.21	17.76	24.69	44.74	46.17	64.18
So. Africa (comm. rand)	23.10	23.57	29.76	60.05	61.27	77.37
Spain (peseta)	982.41	1,011	1,369	2,554	2,628	3,560
Sweden (krona)	55.22	57.38	75.28	143.55	149.18	195.72
Switzerland (franc)	13.43	13.91	18.64	34.90	36.17	48.45
UK (pound)	5.36	5.52	6.90	13.92	14.35	17.93
US (dollar)	9.05	9.25	12.00	23.53	24.05	31.20
West Germany (mark)	15.27	15.74	21.83	39.69	40.93	56.76

¹ Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.



CURRENT MARKET DATA
CONVERSION VALUE

Country (currency)	per lb U as UF ₆			per kg U as UF ₆		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	1.98	1.96	2.45	4.36	4.33	5.40
Belgium (comm. franc)	52.76	53.10	74.46	116.32	117.06	164.15
Canada (dollar)	1.79	1.78	2.34	3.95	3.93	5.17
EEC (ecu)	1.24	1.23	1.70	2.73	2.72	3.75
Finland (markka)	5.95	6.01	8.33	13.12	13.26	18.36
France (franc)	8.57	8.67	12.08	18.89	19.11	26.64
Italy (lira)	1,872	1,899	2,617	4,128	4,187	5,770
Japan (yen)	222.98	217.96	246.90	491.59	480.52	544.32
Netherlands (guilder)	2.85	2.88	4.01	6.29	6.35	8.84
So. Africa (comm. rand)	3.83	3.82	4.84	8.44	8.43	10.66
Spain (peseta)	162.83	163.92	222.50	358.98	361.37	490.53
Sweden (krona)	9.15	9.31	12.23	20.18	20.51	26.97
Switzerland (franc)	2.23	2.26	3.03	4.91	4.97	6.68
UK (pound)	.89	.89	1.12	1.96	1.97	2.47
US (dollar)	1.50	1.50	1.95	3.31	3.31	4.30
West Germany (mark)	2.53	2.55	3.55	5.58	5.63	7.82

SWU VALUE AND UF₆ VALUE

Country (currency)	SWU Value at 0.30% Tails Assay			UF ₆ Value per kg U as UF ₆		
	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)	This Month (Feb 28, 1990)	Last Month (Jan 31, 1990)	12 Months Ago (Feb 28, 1989)
Australia (dollar)	65.92	70.63	84.17	33.28	33.87	42.71
Belgium (comm. franc)	1,759	1,912	2,558	888.14	916.81	1,298
Canada (dollar)	59.70	64.18	80.51	30.14	30.78	40.85
EEC (ecu)	41.30	44.45	58.50	20.85	21.31	29.68
Finland (markka)	198.35	216.54	286.08	100.16	103.85	145.17
France (franc)	285.60	312.07	415.12	144.22	149.67	210.65
Italy (lira)	62,414	68,363	89,921	31,519	32,789	45,631
Japan (yen)	7,433	7,847	8,483	3,754	3,763	4,305
Netherlands (guilder)	95.08	103.69	137.83	48.01	49.73	69.94
So. Africa (comm. rand)	127.62	137.58	166.17	64.44	65.98	84.32
Spain (peseta)	5,428	5,901	7,645	2,741	2,830	3,880
Sweden (krona)	305.06	334.99	420.33	154.05	160.66	213.29
Switzerland (franc)	74.17	81.22	104.05	37.45	38.95	52.80
UK (pound)	29.59	32.22	38.52	14.94	15.45	19.54
US (dollar)	50.00	54.00	67.00	25.25	25.90	34.00
West Germany (mark)	84.35	91.91	121.91	42.59	44.08	61.86

¹ Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

NUEXCO

Monthly Report

April 1990
No. 260

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To Our Readers

The 1989 Annual Review will be mailed to our subscribers this month. This special report summarizes 1989 nuclear fuel industry activities during 1989, and analyzes developments in the spot and long-term uranium and enrichment markets. The NUEXCO Market Values for 1989 are also reprinted in a series of tables for your reference.

If you would like to purchase additional copies of the 1989 Annual Review, please contact Lori Mattics in our Denver office at (303) 899-4500.

* * *

In the March 1990 Monthly Report (No. 259), the *Market Values Expressed in Selected Currencies* tables shown on page six and seven contained numerous data entry errors in the columns labeled "12 Months Ago (Feb 28, 1989)". Corrected versions of these tables are included as inserts this month. We regret any inconvenience to our subscribers.

MARKET VALUES SUMMARY

March 31, 1990

Market Values	This Month (Report 260)	Active Supply* (thousand pounds equivalent U ₃ O ₈)	Active Demand* (thousand pounds equivalent U ₃ O ₈)
EXCHANGE VALUE ¹	\$8.80/lb U ₃ O ₈	3,840**	4,470**
UF ₆ VALUE ²	\$24.40/kg U as UF ₆		
LOAN RATE ³	3.5%/annum	6,270	0
CONVERSION VALUE ⁴	\$1.45/lb U as UF ₆	550	0
SWU VALUE ⁵ 0.3 tails assay:	\$50/SWU	345	95
TRANSACTION VALUE ⁶	\$8.75 Per Pound U ₃ O ₈	13 Transactions	3 Months
			4.4 Million Pounds

* Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

** Includes uranium concentrates and uranium hexafluoride.

DEFINITIONS

¹ The **Exchange Value** is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

² The **UF₆ Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

³ The **Loan Rate** is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

⁴ The **Conversion Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

⁵ The **SWU Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

⁶ The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
b. At least ten transactions;
c. Transactions involving a sum total of at least 2 million pounds U₃O₈ equivalent.

DERIVATIONS AND COMMENTS

• All **Market Values** are based on:

- Data from recently completed transactions.
- Data from pending transactions.
- Firm bids to buy or borrow, and firm offers to sell or lend.
- Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend.

• Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these **Market Values**.

• In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers.

• The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.

• For the **SWU Value**, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the NUEXCO **Exchange Value** and **Conversion Value** determined as of the same date.

• In calculating the **Transaction Value**, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future **Exchange Values** or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined.

• The sample time for the **Transaction Value** is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

PRICING

MARCH MARKET REVIEW

(as of March 31, 1990)

NATURAL URANIUM AND CONVERSION

Short-term Market Activity

In a very active month, the Exchange Value increased for the first time since October 1987. Over five million pounds equivalent U₃O₈ changed hands this month in eight near-term sales. One involved natural uranium concentrates, four involved natural UF₆, and five involved enriched uranium product (EUP). Two transactions involved the sale of both natural UF₆ and UF₆ contained in EUP.

The **Exchange Value** rose \$0.10 to **\$8.80** per pound equivalent U₃O₈. This marks the first time in 29 months that the Exchange Value has increased. One March concentrates sale occurred at an even higher level, but it included special timing considerations. Near-term supply of concentrates has declined in recent months, and near-term demand has increased, so that Active Demand exceeded Active Supply by 700 thousand pounds equivalent U₃O₈ on March 31. Early in March some material was available at \$8.70 per pound, but more recently, prices for natural uranium concentrates have firmed somewhat, and supplies have not been available for sale at that price level.

Namibia became an independent nation on March 21; President Bush immediately lifted US sanctions against imports of Namibian-origin material, and Canada lifted its ban on new contracts for conversion of Namibian material. Although Rössing management has indicated it will not participate in the spot market at current prices, it represents a new source of long-term concentrates supply in markets such as the USA and Canada, which have been closed to Rössing for more than three years. Rössing produced approximately eight million pounds equivalent U₃O₈ in 1989, but has the ability to increase its output by 25 percent in 1990 and beyond.

The **UF₆ Value** dropped to **\$24.40** per KgU as UF₆, down \$0.85 from February 28, 1990. The substantial available quantities of UF₆ and vigorous efforts to stimulate sales continued to exert downward price pressure during March. Seven near-term UF₆ sales are reported for March; four involved natural UF₆ and five involved EUP. (The seven sales included two sales that involved both natural UF₆ and UF₆ contained in EUP.) One of the sales involved the liquifaction of fabricated fuel by Sacramento Municipal Utility District (SMUD), owner of the closed Rancho Seco unit. The seven sales totalled over five million pounds equivalent U₃O₈.

As is customary in the nuclear fuel market, variations in origin, timing, location, and form all affected the final prices in specific sales, especially during March. Utilities, producers, fabricators, and intermediaries all participated in the market as both buyers and sellers this past month. This development, regardless of traditional roles, has become common practice in the uranium market.

* * *

The **Transaction Value** fell to **\$8.75** per pound equivalent U₃O₈ based on 13 transactions over 3 months involving 4.4 million pounds. This is the first time since April 30, 1986 that the Transaction Value has fallen below the Exchange Value. Since the Transaction Value always lags the Exchange Value, it is customary for the Transaction Value to continue downward when the Exchange Value first moves upward after a sustained decline.

* * *

Active Supply of uranium concentrates fell to **3.8** million pounds equivalent U₃O₈, down from the February 28, 1990 level of 5.1 million pounds. In the near term, supplies of concentrates are substantially below levels of a few months ago (especially if buyers restrict origin, form, or location requirements), but the shortage is temporary. Meanwhile, supplies of UF₆ and EUP remain plentiful.

PRICING

Active Demand increased again this month to **4.5** million pounds equivalent U₃O₈. The majority of this demand comes from producers, both to satisfy current contract commitments and for discretionary purchases to inventory.

The **Supply/Demand Ratio** declined to **0.9**, marking the first time in over ten years it has fallen below 1.0. On November 30, 1982, Active Demand equaled Active Supply, but otherwise the Supply/Demand Ratio has always been larger than 1.0. This development tends to support the small upswing in the Exchange Value. However, material available for loan exceeded 6.2 million pounds equivalent U₃O₈, of which, up to 5.0 million pounds are available in the form of concentrates. This material could easily offset the current supply tightness in the concentrates market.

One US utility has recently solicited offers for concentrates, and is expected to make a decision in April. Cameco, the world's largest uranium producer, has been an active buyer in recent months, and is again seeking to purchase concentrates on the spot market.

* * *

Natural Uranium Long-term Activity

The long-term natural uranium market remained fairly active this month. Five long-term sales totalling nearly eight million pounds equivalent U₃O₈ are reported. Four of the transactions concluded sales of concentrates under market-related pricing terms. In the fifth long-term sale, an intermediary sold UF₆ to a utility at a series of fixed prices.

* * *

The **Loan Rate** remained at **3.5** percent per annum. Five loans are reported this month at or near the March 31, 1990 Loan Rate. These loans included nearly 1.6 million pounds equivalent U₃O₈. Intermediaries borrowed the material in all five of these transactions from four utilities and one producer. One loan involved UF₆; the remaining four involved concentrates. Loan supply is abundant and accessible at current market levels. Lenders willing to accept less restrictive origin returns and flexible repayment terms have been the most attractive to borrowers.

The **Conversion Value** slipped to **\$1.45** per pound U as UF₆. Little active demand for conversion exists at present. Two conversion transactions totalling over 600 thousand pounds U as UF₆ took place at price levels above the March 31, 1990 Conversion Value. Nevertheless, the availability of UF₆, and the divergence between the UF₆ Value and the sum of the Exchange and Conversion Values, is putting substantial downward pressure on the Conversion Value. If that continues during April, further price slippage seems likely.

ENRICHMENT SERVICES

The **SWU Value** remains unchanged at **\$50** per SWU. This report notes six near-term sales involving nearly 500 thousand SWU. Four of the sales involved enriched UF₆; the natural UF₆ component of such sales is discussed under uranium sales. There are no long-term enrichment transactions reported, although during March a number of utilities entered the market to fill medium- and long-term SWU needs and are currently evaluating offers. Other utilities will be entering the market in the next few months.

When several utilities liquidated their enriched UF₆ stockpiles during the first quarter of this year, it put substantial downward pressure on SWU prices. However, unless new supplies enter the market soon, prices could move upward, particularly in light of new intermediate-term demand and the reluctance of primary suppliers to sell at current price levels. ■

CURRENT MARKET DATA

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

EXCHANGE VALUE						
Country (currency)	per lb U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)
Australia (dollar)	11.70	11.47	13.12	30.41	29.82	34.11
Belgium (comm. franc)	309.10	306.01	425.79	803.58	795.57	1,107
Canada (dollar)	10.31	10.39	12.78	26.81	27.01	33.23
EEC (ecu)	7.32	7.19	9.70	19.04	18.68	25.23
Finland (markka)	35.29	34.51	45.67	91.74	89.73	118.73
France (franc)	50.25	49.69	68.72	130.63	129.19	178.66
Italy (lira)	11,011	10,860	14,915	28,626	28,234	38,776
Japan (yen)	1,377	1,293	1,427	3,579	3,362	3,711
Netherlands (guilder)	16.82	16.54	22.94	43.72	43.01	59.64
So. Africa (comm. rand)	23.33	22.21	27.39	60.65	57.73	71.20
Spain (peseta)	956.11	944.42	1,268	2,486	2,455	3,297
Sweden (krona)	53.95	53.08	69.21	140.27	138.00	179.93
Switzerland (franc)	13.17	12.91	17.79	34.23	33.55	46.24
UK (pound)	5.38	5.15	6.38	13.99	13.38	16.60
US (dollar)	8.80	8.70	10.70	22.88	22.62	27.82
West Germany (mark)	14.93	14.68	20.35	38.82	38.15	52.89

TRANSACTION VALUE						
Country (currency)	per lb U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)
Australia (dollar)	11.63	11.93	13.80	30.24	31.02	35.86
Belgium (comm. franc)	307.34	318.33	447.67	799.02	827.58	1,164
Canada (dollar)	10.26	10.81	13.44	26.66	28.09	34.94
EEC (ecu)	7.28	7.48	10.20	18.93	19.43	26.53
Finland (markka)	35.09	35.90	48.02	91.22	93.34	124.83
France (franc)	49.96	51.69	72.25	129.89	134.39	187.84
Italy (lira)	10,948	11,297	15,682	28,464	29,370	40,769
Japan (yen)	1,369	1,345	1,501	3,559	3,498	3,902
Netherlands (guilder)	16.72	17.21	24.12	43.47	44.74	62.71
So. Africa (comm. rand)	23.20	23.10	28.79	60.31	60.05	74.86
Spain (peseta)	950.67	982.41	1,333	2,472	2,554	3,466
Sweden (krona)	53.65	55.22	72.77	139.47	143.55	189.18
Switzerland (franc)	13.09	13.43	18.70	34.03	34.90	48.62
UK (pound)	5.35	5.36	6.71	13.91	13.92	17.45
US (dollar)	8.75	9.05	11.25	22.75	23.53	29.25
West Germany (mark)	14.85	15.27	21.39	38.60	39.69	55.61

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

CURRENT MARKET DATA
CONVERSION VALUE

Country (currency)	per lb U as UF ₆			per kg U as UF ₆		
	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)
Australia (dollar)	1.93	1.98	2.39	4.25	4.36	5.27
Belgium (comm. franc)	50.93	52.76	77.60	112.28	116.32	171.07
Canada (dollar)	1.70	1.79	2.33	3.75	3.95	5.14
EEC (ecu)	1.21	1.24	1.77	2.66	2.73	3.90
Finland (markka)	5.81	5.95	8.32	12.82	13.12	18.35
France (franc)	8.28	8.57	12.52	18.25	18.89	27.61
Italy (lira)	1,814	1,872	2,718	4,000	4,128	5,992
Japan (yen)	226.85	222.98	260.14	500.11	491.59	573.51
Netherlands (guilder)	2.77	2.85	4.18	6.11	6.29	9.22
So. Africa (comm. rand)	3.84	3.83	4.99	8.47	8.44	11.00
Spain (peseta)	157.54	162.83	231.10	347.32	358.98	509.48
Sweden (krona)	8.89	9.15	12.61	19.60	20.18	27.81
Switzerland (franc)	2.17	2.23	3.24	4.78	4.91	7.15
UK (pound)	.89	.89	1.16	1.95	1.96	2.56
US (dollar)	1.45	1.50	1.95	3.20	3.31	4.30
West Germany (mark)	2.46	2.53	3.71	5.42	5.58	8.17

SWU VALUE AND UF₆ VALUE

Country (currency)	SWU Value at 0.30% Tails Assay			UF ₆ Value per kg U as UF ₆		
	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)	This Month (Mar 31, 1990)	Last Month (Feb 28, 1990)	12 Months Ago (Mar 31, 1989)
Australia (dollar)	66.47	65.92	82.16	32.44	33.28	40.46
Belgium (comm. franc)	1,756	1,759	2,666	857.04	888.14	1,313
Canada (dollar)	58.60	59.70	80.04	28.60	30.14	39.42
EEC (ecu)	41.61	41.30	60.77	20.31	20.85	29.92
Finland (markka)	200.50	198.35	285.96	97.84	100.16	140.84
France (franc)	285.50	285.60	430.31	139.33	144.22	211.94
Italy (lira)	62,563	62,414	93,393	30,531	31,519	45,999
Japan (yen)	7,822	7,433	8,938	3,817	3,754	4,402
Netherlands (guilder)	95.55	95.08	143.65	46.63	48.01	70.75
So. Africa (comm. rand)	132.56	127.62	171.49	64.69	64.44	84.46
Spain (peseta)	5,432	5,428	7,940	2,651	2,741	3,911
Sweden (krona)	306.56	305.06	433.38	149.60	154.05	213.45
Switzerland (franc)	74.81	74.17	111.37	36.51	37.45	54.85
UK (pound)	30.57	29.59	39.98	14.92	14.94	19.68
US (dollar)	50.00	50.00	67.00	24.40	25.25	33.00
West Germany (mark)	84.83	84.35	127.40	41.40	42.59	62.74

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.



CURRENT MARKET DATA

RECENT TRANSACTIONS

URANIUM SALES ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U ₃ O ₈)	Approximate Price Range ² as Percent of Current Exchange Value or UF ₆ Value	Buyer	Seller	Remarks
4772A	1990	601-1,000	R ³	Intermediary	Utility	Contained in EUP
4776A	1990	100-300	R ³	Utility	Intermediary	Contained in EUP
4780A	1990	1,001-3,000	See Remarks	Utility	Fabricator	UF ₆ and EUP/Price Related To Market
4781A	1990	1,001-3,000	R ³	Fabricator	Utility	UF ₆ and EUP
4782A	1990	101-300	R ³	Utility	Fabricator	Contained in EUP
4783	1990	301-600	98-102	Utility	Intermediary	UF ₆
4786	1992-97	1,001-3,000	See Remarks	Utility	Producer	Base Price Escalated
4787	1993-97	1,001-3,000	See Remarks	Utility	Producer	Base Price Escalated
4788	1990	101-300	98-102	R ³	Intermediary	UF ₆
4791	1990	101-300	98-102	Producer	Intermediary	
4792	1991-96	3,001-6,000	R ³	R ³	R ³	
4793	1990-92	301-600	See Remarks	Utility	Intermediary	UF ₆ /Series of Fixed Prices
4794	1992-97	1,001-3,000	See Remarks	Utility	Producer	Base Price Escalated

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

CURRENT MARKET DATA
NATURAL URANIUM LOANS¹

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U ₃ O ₈)	Approximate Price Range ² as Percent of Current Loan Rate	Borrower	Lender	Remarks
4764	1990	301-600	98-102	Intermediary	Utility	
4777	1990	101-300	98-102	Intermediary	Producer	
4778	1990	101-300	98-102	Intermediary	Utility	
4784	1990	101-300	98-102	Intermediary	Utility	
4795	1990	301-600	98-102	Intermediary	Utility	UF ₆

**CONVERSION SERVICES
SPOT MARKET SALES¹**

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds U as UF ₆)	Approximate Price Range ² as Percent of Current Conversion Value	Buyer	Seller	Remarks
4789	1990	101-300	103-107	Utility	Intermediary	
4790	1990	301-600	108-112	Utility	Converter	

**ENRICHMENT SERVICES
SECONDARY MARKET SALES¹**

NUEXCO Transaction Number	Delivery Period	Approximate Quantity ⁴ (thousand SWUs)	Approximate Price Range ² as Percent of Current SWU Value ⁵	Buyer	Seller	Remarks
4772B	1990	101-300	R ³	Intermediary	Utility	Contained in EUP
4776B	1990	50-100	R ³	Utility	Intermediary	Contained in EUP
4780B	1990	50-100	See Remarks	Utility	Fabricator	Price Related To Market
4781B	1990	101-300	R ³	Fabricator	Utility	Contained in EUP
4782B	1990	Less Than 50	R ³	Utility	Fabricator	Contained in EUP
4785	1990	50-100	98-102	Utility	Intermediary	

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

⁴ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 % tails assay.

⁵ Prices are usually normalized to 0.30% tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.



CURRENT MARKET DATA

URANIUM SUPPLY (March 31, 1990)			
Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
89-1001	1,300	1,300 per year	1990-93, UF ₆
89-1201	2,000	3,000 per year	1990-93
89-7000A	500	—	1990, UF ₆
90-1051*	40	—	1990, UF ₆
90-1027	—	300 per year	1991-2000
Total	3,840		
INACTIVE			
89-1076	500	250 per year	1990 on
89-1156	200	—	1990
89-1173	750	—	1990
89-1180	1,000	—	1990
89-1209	400	400 per year	1990-93
90-1000A	655	—	1990, UF ₆
87-1000	—	600 per year	1991-95
87-1123	—	1,000 per year	1990 on
88-1157	—	1,000 per year	1990 on, UF ₆
Total	3,505		
* New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 88-1096A, 89-1128, 89-1252.			

CURRENT MARKET DATA

URANIUM DEMAND (March 31, 1990)			
Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
89-1183	400	—	1990
89-1229	100	—	1990
90-1026	100	—	1990
90-1034	300	—	1990
90-1038*	800	—	1990
90-1045A	405	—	1991, UF ₆
90-1046	600	—	1990
90-1060*	200	—	1990
90-1064*	650	—	1990, UF ₆
90-1067*	500	600 per year	1990-96
90-1069*	75	—	1990, U ₃ O ₈ /UF ₆
90-1074*	340	—	1990
.....			
89-1233	—	160	1991, UF ₆
89-1254	—	270 per year	1991-2000
89-1256	—	200 per year	1991-94
89-1260	—	250 per year	1992-94
90-1024	—	250 per year	1992-2001
Total	4,470		
INACTIVE			
89-1067	500	—	1990
89-1175	170	170 per year	1990-91
90-1001	350	—	1990
90-1008	130	—	1990
.....			
90-1017*	—	500	1991
Total	1,150		
[*] New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 89-1090, 90-1019A, 90-1020A, 90-1048.			



CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND (March 31, 1990)			
NUEXCO Project Number	Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)		Remarks
	Within 1 Year	Beyond 1 Year	
Available for Loan:			
ACTIVE			
88-1182	4,000	—	U ₃ O ₈ /UF ₆
90-1016	300	—	U ₃ O ₈
90-1031	500	—	U ₃ O ₈
90-1033	1,270	—	UF ₆
90-1036*	200	—	U ₃ O ₈
Total	6,270		
INACTIVE			
<i>None reported</i>			
Inquiries to Borrow:			
<i>No inquiries to borrow are reported</i>			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 89-1225, 90-1041.			

CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND (March 31, 1990)			
Delivery Period ¹ (Thousand Pounds of U as UF ₆)			
NUEXCO Project Number	Within 3 Years	Beyond 3 Years	Remarks
Available for Sale			
ACTIVE			
89-7000C	400	—	
89-7002	150	—	
Total	550		
INACTIVE			
<i>None reported</i>			
Inquiries to Purchase			
ACTIVE			
<i>No inquiries to purchase are reported</i>			
INACTIVE			
<i>None reported</i>			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 89-7001A, 90-1028, 90-1040.			



CURRENT MARKET DATA

SWU SUPPLY AND DEMAND (March 31, 1990)			
Delivery Period ¹ (Thousand SWUs)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Available for Sale ACTIVE			
88-1082	100	—	1990
89-7000B	100	—	1990
90-1073*	145	—	1990
Total	345		
INACTIVE			
88-1210	200	200 per year	1990-93
90-1000B	150	—	1990, UF6e
Total	350		
Inquiries to Purchase ACTIVE			
90-1045B	95	—	1991, UF6e
88-1061	—	500	1991-95
89-1262	—	120 per year	1996-99
90-1022A	—	235 per year	1996-99
90-1022B	—	900 per year	2000-13
90-1035*	—	300 per year	1996-2000
90-1052*	—	280 per year	1996-on
90-1071*	—	150 per year	1992-94
Total	95		
INACTIVE			
89-1043	50	—	1990
89-1047	—	600	1991-95
Total	50		
* New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 88-1096B, 89-7001B, 90-1019B, 90-1020B, 90-1032.			

RECENT DEVELOPMENTS

RECENT DEVELOPMENTS

USCEA Fuel Cycle '90 Conference

At the US Council for Energy Awareness Fuel Cycle '90 Conference in Nashville, Tennessee, held March 25-28, discussions centered on the many changes occurring in the industry, particularly regarding increased internationalization of suppliers. The future of the enrichment market held a prominent place in conversation, as participants speculated about the future of DOE, Louisiana Energy Services (LES), the possibility of an Australian enrichment plant, and Technsnabexport's growing role in the marketplace. Summaries of some of the papers presented at the conference follow.

THE CHANGING NUCLEAR FUEL INDUSTRY

NRC Licensing

Forrest J. Remick of the Nuclear Regulatory Commission (NRC) discussed the progress of NRC licensing. The one-step license process, which provides for a combined construction and operating license, is expected to provide stability to the nuclear industry by requiring a hearing on the completed design and allowing for public participation prior to the start of construction. Provided the licensee builds the plant according to the license, the plant will be allowed to operate. In answer to a question from William D. Magwood of the Edison Electric Institute, Commissioner Remick stated that this type of license should reduce the effectiveness of delay tactics used by antinuclear groups.

US National Energy Strategy

Assistant Secretary for Nuclear Energy, William H. Young, referring to the National Energy Strategy, stated that DOE's major objective is an open and informed national consensus for a secure, sensible energy future. He encouraged vocal participation in turning around public attitudes about nuclear power, and anticipates restoring viability to the uranium industry by the end of the 1990s. He also expects to see new plants operational by the late 1990s. All of this is subject, however, to the resolution of several issues, including restoring public confidence in nuclear power by:

- ◆ demonstrating attention to safety, environmental protection, and enhanced operational performance;

- ◆ improving the economics of nuclear power through restructuring of the uranium enrichment enterprise and deployment of AVLIS;

- ◆ demonstrating significant progress on nuclear waste disposal.

In response to questions from attendees, Mr. Young stated that DOE is also planning to improve the domestic uranium mining industry by attracting foreign buyers to purchase domestic uranium. Although DOE is primarily involved in the US National Energy Strategy, it very strongly supports participation in international discussions on worldwide energy issues, including global warming.

TVA's Nuclear Program

Tennessee Valley Authority's Oliver D. Kingsley, Jr., discussed the progress of TVA's nuclear program, and pointed out that the company had succeeded in stabilizing rates and reducing overhead through careful planning. Its goals for 1990 include the restart of Unit 2 at Browns Ferry and plans to make significant progress towards startup of Watts Bar Unit 1.

Internationalization of the Nuclear Fuel Industry

Richard J. Sills of British Nuclear Fuels, plc. (BNFL) explored the issue of internationalization of the nuclear fuel industry. Clients and industry can realize many benefits through shared technology. Information on technology, cost estimation, construction, and scheduling performance can be made available to the USA through acquisitions, mergers, joint ventures, and teaming. LES is an example of such cooperation and collaboration. By integrating their information and methodologies, companies are able to reduce the risk of new ventures.

Congress and Nuclear Energy

The industry needs communicators and public understanding, according to US Senator Jim McClure of Idaho. "There is growing confidence in this prolonged era of economic expansion but we need to have confidence in the future as well." Senator McClure believes Congress should be concerned about global environmental impacts such as global warming and high-level waste disposal, but should emphasize solutions for domestic energy and environmental problems, then pursue international issues.

RECENT DEVELOPMENTS

URANIUM ACTIVITIES

Preliminary EIA 1989 Market Data

Howard L. Walton's report on the Energy Information Administration's preliminary uranium market data for 1989 notes that between 1980 and 1989 Canada's world market share increased from 16 to 32 percent. During the same time, Australia's world share more than doubled from 4 to 10 percent, while the US share declined from 38 to 15 percent. The current decline in the spot market price has contributed to prices for material delivered under long-term contracts falling from \$25.65 per pound in 1988 to \$19.43 per pound in 1989.

US commercial inventory levels declined by 15 percent from 1988 to 1989, and unfilled requirements for the next ten years increased by 35 million pounds in 1989. For 1992, US utilities report over 11 million pounds of uncommitted demand, increasing to over 30 percent of their requirements uncommitted by 1993. Mr. Walton added that many utilities are completely uncommitted in the late 1990s.

Spot vs. Long-Term Contracting

In attempting to answer the questions, "Where is it all coming from?" and "When will it end?", James J. Graham, President and CEO of Total Minerals Corporation (Total), discussed long-term contracting versus the spot market. Although Total prefers to sell under long-term contracts, the company is equally amenable to selling on the spot market, provided such sales provide the returns required by the corporation. Total believes a larger spot market would reduce the influence of any one particular group. It also feels this would result in more sales between principals and reduce dependence on intermediaries.

Arizona Public Service Procurement Strategy

Paul F. Crawley of Arizona Public Service Company (APS) described the company's philosophy on uranium contracting, which is similar to many others in the industry. APS does not rely completely on the spot market, but satisfies approximately 75 percent of its projected needs under long-term contracts with minimum commitments, flexible terms, and price protection in the form of ceiling prices. APS has diversified its uranium contracting to include nine contracts with seven suppliers and a variety of pricing terms. The company is fully covered with firm commitments through 1997, and with optional coverage through the year 2000. APS has made three spot market

purchases over the past three years. It plans to apply this strategy to all components of the fuel cycle, and has taken initial steps towards applying it to UF₆ and conversion.

The Long and Short of It

George White, Jr. of NUEXCO, reports that although the market may appear to be changing dramatically, it has really not changed much at all. For example, the NUEXCO Exchange Value reached an all-time low (adjusted for inflation) on February 28, 1990, record quantities of uranium are moving through the spot market, broker/traders are becoming increasingly active in the marketplace, and major restructuring is taking place in the uranium production industry. Nevertheless, inventory remains the key player in the marketplace.

The one element that has consistently affected the market is the level and usage (or non-usage, as the case may be) of utility and producer inventories. It has had a resounding effect on both the spot market and the long-term market. As inventories are moved and traded, increased and decreased, the spot price has declined. Until excess inventories are absorbed, no real price recovery is possible. In his closing statement he summarizes, "Neither the general situation nor this particular message has changed much during the past several years. What has changed, or should have changed, is our recognition of the situation—specifically, that the rationalization of the uranium market is proving to be a longer rather than a shorter process." (Mr. White's speech is reprinted on page 21.)

Liability of Shipping Radioactive Materials

Robert L. Bovey of NuTranS, spoke about the potential liability of shipping radioactive materials. Although the industry maintains an excellent safety record, it is important to fully understand one's particular insurance needs and how they work—before an accident occurs. Mr. Bovey examined the potential for even remote parties to be included in a lawsuit to reclaim damage for personal injury or property damage, as well as cleanup and environmental restoration, emergency forces actions, legal fees, and fines. He discussed the cost implications and suggested that managers evaluated on their cost containment performance may not use the proper insurance in an effort to enhance their performance appraisals. Mr. Bovey emphasized that the best protection is to be familiar with your entire policy and verify that your perceived and actual coverage are the same. (Mr. Bovey's speech is reprinted on page 25.)

RECENT DEVELOPMENTS

ENRICHMENT ACTIVITIES**TECHSNABEXPORT (TENEX)**

Mr. Alexander G. Chernov, Deputy Director General of Techsnabexport (TENEX), presented an overview of the Soviet Union's activities in uranium and uranium enrichment. He noted that because of the high purity of the uranium oxides processed, the technology for processing uranium/fluorine compounds or metallic uranium is greatly simplified. He also explained that Soviet gas centrifuges operate very reliably, and provided background on TENEX contracting activities. In the early 1970s, the organization began its marketing effort, executing agreements to supply enrichment to almost all West European countries. Most of these contracts are still in place today, extending through 2000 or even 2010. Mr. Chernov was quick to point out that TENEX contracts are not standardized and that each is individually tailored to meet the needs of its customers. Since 1988, TENEX has been shipping enriched uranium product. It has the capability to export up to three million SWU annually, and the potential for more. TENEX is prepared to supply both long-term and short-term contracts for natural or enriched uranium, and is eager to participate in the enrichment market.

AVLIS Demonstration and Deployment

Philip G. Sewell (DOE) summarized the AVLIS Demonstration and Deployment Plan submitted to Congress in January, and requested that utilities participate in the legislative process of restructuring, licensing, and AVLIS deployment. He stated that "the future is now, the choice is yours, and if you sit back and watch you won't be happy with the outcome." In response to a question of whether the demonstration report due September 1992 would identify costs, Sewell's response was that it should form the foundation from which to offer new contracts and determine enrichment prices. Regarding the timetable under which Congress must act in order for DOE to maintain its schedule, Sewell explained that the plan identifies activities in 1990, 1991, and 1992. Congress has already appropriated money for FY1990 and will be acting on legislation appropriating money for FY1991. Preliminary indications are that they will appropriate the monies necessary.

For a question on how the electricity consumption compares between AVLIS and the existing gaseous diffusion plants, Mr. Sewell's answer was "very close; power costs should be comparable." When asked whether DOE would pursue dumping action against TENEX,

Mr. Sewell stated he was unable to answer. Later during the session he indicated that DOE wants to explore the possibility of private entities willing to invest in AVLIS.

LES Progress

W. Howard Arnold reported on the progress of Louisiana Energy Services (LES). The formal partnership agreement is nearly finalized, and an agreement between the four governments involved in importing software and hardware (under development since the middle of 1989) is expected to be signed in April. The partners are working in parallel on several other issues, including purchasing the plant site (approximately 450 acres in Northwestern Louisiana near the towns of Homer and Haynesville), and licensing under parts 40 and 70 of the Atomic Energy Act rather than under part 50. LES will submit its license application in January 1991, and expects to receive the license around the end of 1992. Production is scheduled to begin in 1996, so LES is targeting this date for delivery under new contracts. When asked why LES was investing in an oversupplied industry, with slow growth and high costs, Mr. Arnold's response was, "Can the new plant provide a return on investment? The answer is a resounding yes."

A Utility Perspective on Enrichment

A utility perspective on new enrichment technologies was provided by Andrew F. Yaros of Virginia Power Co. (VEPCO). VEPCO believes that new technologies are important because they provide a source of competition, improve market efficiency, and provide potential for reduced costs. The company is optimistic about CRISLA (Chemical Reaction by Isotope Selective Laser Activation), centrifuge technology, and existing GDPs. However, VEPCO seriously doubts AVLIS's ability to compete in the future market. When asked how much supply he thought US utilities would purchase from TENEX, Mr. Yaros said "that, based on DOE's proposal to get money to buy alternative supply, we may all get TENEX SWUs."

Enrichment in Australia

Although Michael P. Goldsworthy is convinced that Australia should enter the enrichment market in the 1990s, his fellow countrymen are not sure. Mr. Goldsworthy stated that one individual even requested that he withdraw his paper. While he was very optimistic, Mr. Goldsworthy acknowledged that Australia does not have the technical expertise for such a venture and would have to rely on technology transfers from other countries.

RECENT DEVELOPMENTS

Isotope Technologies

In a question and answer period near the end of the session, Mr. Yaros asked a question to the session chairman, John Longenecker, President and CEO of Isotope Technologies, Inc. (ITI), about why and how ITI planned to compete in the enrichment market. Mr. Longenecker responded that ITI is pursuing it for three reasons:

- low capital costs
- low operational costs
- simple hardware

He also added that ITI has private funding and is starting out on a small scale.

HIGH-LEVEL WASTE AND TRANSPORTATION

The session on high-level waste and transportation centered around the problems DOE has had meeting the scheduled deadline for receiving fuel and the plan for interim storage (Monitored Retrievable Storage). All speakers emphasized the importance of identifying a realistic plan and corresponding schedule and meeting each of the targets on time. The recent lawsuit brought by the Department of Justice against the State of Nevada could

adversely affect the program. According to C. Frederick Sears of Northeast Utilities, some Public Utility Commissions appear to be reconsidering the entire program. US utilities have contributed over \$4 billion to the Nuclear Waste Fund, but DOE has yet to demonstrate that a repository (temporary or permanent) will be available by 1998 as scheduled.

FUEL CYCLE ISSUES

The final session of the conference covered EPA radionuclide standards and amendments to the Clean Air Act, as well as trends in fuel fabrication. Lucinda L. Swartz of the Senate Environment and Public Works Committee said that "regulation under both the Atomic Energy Act and Clean Air Act is burdensome, wasteful, and unnecessary. Dual regulation is costly and does not provide any additional protection for the public."

John O'Neill, Jr. warned fuel buyers to beware of the typical or standardized ("boiler plate") fuel procurement contracts. He advised listeners to use caution with contracts that do not adequately address issues such as unforeseen events (force majeure), limits of liability, warranties, government law, and resolution of disputes. ■

RECENT DEVELOPMENTS

WASHINGTON FOCUS

Congress devoted much of March to discussion of amending the Clean Air Act, postponing action on other issues such as the budget for FY1991. On April 3, for the first time since enactment of the original Clean Air Act of 1970, the Senate voted 89 to 11 to tighten emission standards. The House Energy & Commerce Committee is hard at work on its version of a Clean Air bill. The Department of Energy released its draft National Energy Strategy, with "energy efficiency" as its major theme. The draft examines various options on the supply and demand side of the energy equation. It also covers a range of options, including nuclear energy, but makes no choices or recommendations. DOE will adjust its budgetary framework for FY1992 to reflect the options selected from the report. The White House is expected to release the final report sometime in 1991.

Radionuclide Emissions Regulations

Prior to final passage of the Clean Air Act, Sen. Alan Simpson (R-WY) offered a new amendment that would exempt the EPA from setting radionuclide emissions standards for facilities already licensed by the NRC unless the EPA Administrator found that the NRC regulations "do not provide an ample margin of safety to protect the public health." This latest amendment was approved when a motion to table failed by a vote of 33 to 67. An amendment offered earlier in March to prevent this dual regulation had failed after it became a battle over states' rights.

On March 21, the EPA announced a 120-day stay of the section of its final radionuclides rule that applies to companies already regulated by the NRC. Petitions from the nuclear industry contesting the dual regulation set forth by the Atomic Energy Act were filed with the D.C. Circuit Court, enabling EPA to issue the stay. EPA will continue to analyze these comments for reconsideration of the final rule. The regulations, published December 15, 1989, were to have gone into effect March 15.

LES Licensing Procedures

The House Interior and Insular Affairs Committee held a hearing March 6 on licensing requirements for private uranium enrichment facilities [specifically, for Louisiana Energy Services (LES)], and reviewed a Senate amendment to a public lands bill that would place enrichment facilities under the same licensing requirements as a materials processing facility. Sen. J. Bennett Johnston (D-LA), representing the state in which the plant will be built, spoke about the dire economic effects of a delay in licensing, and explained the differences between enrichment plants and nuclear power plants. Following his testimony, Committee members agreed that enrichment plants and nuclear power plants should have different licensing requirements. Rep. George Miller (D-Calif) expressed his belief that an Environmental Impact Statement (EIS) should be prepared prior to licensing, and that adequate public hearings should be conducted. He added that licensing issues should be addressed before the onset of construction.

Sanctions Against Namibia Lifted

President Bush issued a March 21 statement revoking anti-apartheid sanctions against Namibia and establishing diplomatic relations with the newly-independent nation. The President noted, "We welcome Namibia as a full trading partner and are taking steps to ensure that it is given access to the American market."

RECENT DEVELOPMENTS

Downwinders Trust Fund

The House Judiciary Committee approved H.R. 2372, which would establish a \$100 million trust fund to compensate uranium miners and citizens in Arizona, Colorado, New Mexico, Nevada, and Utah who were exposed to fallout from the Nevada test site. The "downwinders" legislation establishes a \$100,000 compensation cap for each uranium miner, and \$50,000 for each affected citizen.

Mill Tailings Lawsuit

The US Court of Appeals for the Federal Circuit upheld a lower court ruling that dismissed the lawsuit brought by eight uranium mining companies against the federal government over cleanup responsibility of old mill sites. The miners asserted that the government was responsible, since all uranium produced between 1950 and 1970 from the subject mill sites was under contract to the Atomic Energy Commission. At that time, the expense of tailings cleanup was not foreseen, and was not included in the supply contracts. The Court found that the 1978 Uranium Mill Tailings Radiation Control Act (UMTRCA) effectively placed the burden of environmental cleanup on producers, and that the government had no contractual responsibility for these sites.

Proposed EPA Elevation

Legislation first introduced January 23 elevating the EPA to a cabinet level department has reached both the Senate and House floors for action. The House Government Operations Committee approved H.R. 3847 in mid-March, which would create a Department of Environmental Protection. Elevating the importance of the EPA would indicate support for the growing environmental movement. A new Department of Environmental Protection could take over the NRC's environmental responsibilities. ■

INDUSTRY BRIEFS

Soviet Union to Build Iran Nuclear Plant

The Soviet Union signed an agreement on March 6 to build two 440-MWE nuclear power plants in Iran, as well as assist in the completion of the Bushehr reactors on which construction was suspended following the revolution. In partial payment, Iran will annually export over 100 billion cubic feet of natural gas to the Soviet Union.

♦ ♦ ♦

Denison Announces Cuts In Elliot Lake Production

Denison Mines Ltd. announced that by August it will reduce annual Elliot Lake production to 2.7 million pounds equivalent U₃O₈, compared to the previous rate of 4.3 million pounds. This 37% reduction will result in the elimination of 450 jobs.

♦ ♦ ♦

Soviet Environmental Study Delays Rostov Startup

The startup has been delayed for the Soviet Union's first nuclear reactor at the Rostov station due to a pending environmental impact study. A decision on whether to start up the VVER-1000 unit located near Volgodonsk will be made this fall.

Cogema Closes Two Mines, Others To Follow

Cogema has closed its Ecarpière uranium mine at Getigne and suspended activities at Piriatic, due to high extraction costs. The Chardon-en-Loire and La Commanderie operations will be closed by 1991, and the concentrate plant operated by Cogema's subsidiary, Société Industrielle des Minerais de l'Ouest, will be closed thereafter.

♦ ♦ ♦

Namibian Sanctions Lifted By USA and Canada

US President Bush lifted anti-apartheid sanctions against Namibia on March 21, the same day Namibia became an independent nation. Canada also lifted its ban on new contracts for conversion of Namibian material. Namibia has become the 160th member of the United Nations and, by invitation, has also accepted the 50th membership in the Commonwealth of Nations.

U.S. Energy & Kennecott Restructure Joint Venture

On March 22, U.S. Energy, its subsidiary Crested Corp., and Kennecott Corp. agreed to a restructured joint venture agreement for the development of uranium properties in Wyoming. Kennecott will now be equal owners with U.S. Energy and Crested, providing \$15 million to develop the properties, and \$50 million to fund uranium mine development. The first development will be at Green Mountain, which has reserves of more than 50 million pounds.

♦ ♦ ♦

Australians Reelect Hawke

Australians reelected Prime Minister Bob Hawke for a fourth term by the narrow margin of only two seats in the 148-seat House of Representatives. Shortly before his reelection, the Prime Minister stated that he thought the Australian Labor Party's (ALP) three-mines policy would stay in effect, a view supported by ALP Resources Committee Chairman John Black.

RECENT DEVELOPMENTS

**China To Buy 2,000 MWe
Soviet Nuclear Plant**

China has begun negotiations with the Soviet Union to purchase a 2,000-MWe nuclear power plant. The plant would be located on the coast near Jinzhou, which is in the province of Liaoning in Northeast China.

♦ ♦ ♦

**Olympic Dam's First Sale
of Concentrates to USA**

Olympic Dam Joint Ventures has received approval from the Australian government for its first sales of natural uranium concentrates to US utilities. Long-term supply contracts were signed with Texas Utilities and System Fuels.

**Uranerz Buys One-Third
of Cogema's Rabbit Lake
Operations**

Uranerz Exploration and Mining Ltd., a subsidiary of Uranerzbergbau GmbH, reached an agreement with Cameco on April 2 to purchase a one-third interest in Cameco's Rabbit Lake uranium mining operations for C\$160 million. These operations include the Rabbit Lake mill, the three Collins Bay deposits, the Eagle Point South deposit, and surrounding properties. Uranerz presently holds a one-third interest in the Key Lake uranium mine and the Eagle Point North deposit; the latter will be developed with the Eagle Point South deposit as one mine. Uranerz Chairman and CEO Gerhard Glattes stated, "The future of the uranium industry belongs to Saskatchewan. We are anxious to put our company in an advantageous position to capitalize on anticipated future increases in uranium demand. We are confident that the nuclear option for generating electricity has long-term growth potential around the world."

**East and West Germany
Forming Joint Nuclear Law**

East and West Germany began discussions to establish a common German nuclear law by 1991. Solid results are expected within a couple of months, as the rapid pace of the reunification efforts of the two countries are pressuring the panel of experts involved in the discussions to move quickly.

♦ ♦ ♦

**Nova Scotia Extends
Uranium Exploration Ban**

Nova Scotia extended its moratorium on uranium exploration for five more years. The moratorium was originally imposed by the provincial government in 1981.

THE LONG AND THE SHORT OF IT

or

How the buildup of excess uranium inventories inevitably led to the collapse of spot market prices and the subsequent softening of long-term prices and the role of various market participants in forcing a difficult and lengthy restructuring of the world uranium production industry.

The following is a slightly edited version of the paper presented by George White, Jr., Vice President of NUEXCO Trading Corporation, to the USCEA Fuel Cycle '90 Conference in Nashville, Tennessee on March 26, 1990.

Introduction

If asked to characterize the current uranium market, a few of the words that come to mind, depending on one's role in the market and point of view, include "DISASTROUS", "EXCITING", "WORRISOME", and "OPPORTUNE". Looking at that market, I see it dominated by the following, interrelated factors:

- ◆ Record large quantities of uranium are being bought and sold in the spot market, with perhaps equally large, additional quantities being delivered at spot prices under long-term contracts.
- ◆ Structural changes are occurring in both the long-term uranium market and the uranium production sector.
- ◆ Brokers, traders and other intermediaries are becoming increasingly active in the marketplace.
- ◆ The NUEXCO Exchange Value and other spot market price indicators are at all-time lows.

It is my contention, however, that the current state of affairs in the uranium market is the logical and inevitable economic result of past excesses, primarily the buildup, during the late 1970s and early 1980s, of huge inventories. Today there is still substantial excess inventory in the system, and, until this inventory is absorbed, either prospectively or in fact, uranium prices will remain under pressure.

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The Spot Market

It will come as no surprise that the spot market has again become a center of attention, and that criticism typically directed at traders and brokers has been expanded to include the spot market itself. Of course, the targets of that criticism, myself and NUEXCO included, view such abuse as misdirected—akin to shooting the messenger. But to ensure that we are talking about the same thing, we need to take, at least, a cursory look at the spot market.

I would suggest that, with some few exceptions, spot uranium deals typically involve:

- ◆ A fixed quantity of material;
- ◆ Delivery within 12 months or so of contract execution;
- ◆ A relatively simple contract form;
- ◆ A fixed price, known, of course, as a spot price.

Using the NUEXCO Exchange Value as an indicator, the uranium spot price attained its highest level ever in mid-1978, at more than \$43.00 per pound U₃O₈. But since then, with the exception of two up-ticks that

proved short-lived and failed to stem the basic downward trend, the spot price has declined steadily—for nearly 12 years now—and is currently below \$9.00 per pound U₃O₈.

Due to this seemingly endless price decline, there have been recent suggestions that the spot market has, somehow, ceased to be a bona fide market and its prices have become mere contrivances that lack legitimacy. From what I can determine, such suggestions share the implied rationale that, since the brokering/trading/consulting/publishing fraternity are neither consumers nor producers of uranium, their activities, including the prices associated with those activities, should not really be considered as part of the "real" uranium market.

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It will not surprise you that I take issue with such a point of view. It is, I think, readily apparent that those who report on and presume to measure the uranium market do so from different perspectives. But as different as they are, NUEXCO, Nukem, Uranium Exchange, the World Nuclear Fuel Market (with both utility and producer members), and even McGraw-Hill's Nuclear Fuel newsletter all agree, both that there is an active spot market for uranium and that the current price level in that market is somewhere in the neighborhood of \$9.00 per pound U₃O₈. I suggest that such uniformity of opinion from such diverse, wholly independent and informed sources, with obviously divergent agendas, makes a persuasive case for the existence, legitimacy, and price level of the spot market, particularly one in which nearly 30 million pounds equivalent U₃O₈ have changed hands during the past 15 months. In my view, the spot market and its reported price levels are both valid, regardless of who may elect to deal in that market.

The Inventory Situation

And what can we say about the seemingly infinite amounts of uranium that have been fueling all this spot market activity and forcing lower prices? Excess inventory remains the name of the game, and its market impact can hardly be over-stated. Inventory peaked in 1985 at more than 550 million pounds equivalent U₃O₈, half of it excess. By the end of 1989, total inventory had declined to 440 million pounds, with the excess component estimated at about 160 million pounds. At this rate it will be some time in the mid-1990s before the last of this excess is absorbed. Until then, the realities of dealing with the excess will continue to cause considerable difficulties for uranium producers as well as primary suppliers of conversion and enrichment services.

And what about the sources of all this material? Some comes from utilities and government entities who have elected to sell inventory they have come to regard as excess. Some comes from producers who, needing cash in the near-term, have been forced to sell either current production or material that had been stockpiled in hopes of higher priced sales at some future date. Most, however, is being made available through a variety of financially driven transactions, including loans, sales, and swaps, some of which are extremely complex, involving both natural and enriched uranium of different origins at multiple locations.

In this connection there are special considerations applicable to sales of borrowed uranium. The sale of such material incurs an obligation to return equivalent material at a future date. Unless the borrower covers this obligation by arranging to acquire replacement material, he is short the market and at risk. If, on the other hand, the borrower does effect cover by arranging to obtain replacement material, it might be argued that it is the party providing the replacement material that is really making the loan. Thus, the original borrower, *depending on the terms of the deals*, may be able to lock in a profit without taking any market risk.

The rate of inventory utilization is the key and is a function of the comparative rates of consumption and production. It seems clear that little can be done to increase consumption, and uranium consumption (what is burned) during the rest of this century is predictable within narrow bounds. With the average tails assay already close to 0.30% U₂₃₅ and higher assays unlikely, additional consumption via this route is not anticipated. In fact, just the opposite is more likely to happen—namely that uranium consumption will be reduced as declining SWU prices lead to lower tails assays.

Of course, it is possible to increase spot uranium demand (what is sought for purchase at a particular time) by lowering spot prices to the point that some consumers will evaluate a "buy-and-hold" strategy as economically superior to long-term procurement. But, it must be recognized that a "buy-and-hold" does not consume any uranium; it merely moves that particular lot of uranium from one inventory holder to another—from weak to strong hands. Also note that the new owner incurs carrying costs in connection with his "buy-and-hold" strategy. And it is possible that this new owner might, as a result of altered circumstances, later decide, in order to reduce those carrying costs, to become a lender, putting that particular lot of uranium in play yet again, and once again adding to supply at a particular time.

If neither consumption nor demand can alter the equation significantly, we are left with inventory itself and production. Starting with inventory, it will be apparent that as the Minimum Acceptable Inventory Level (MAIL) increases, excess inventory decreases by a like amount; this, in turn, hastens the day when excess inventory will be insufficient to make up any production shortfall. In fact, however, the opposite has happened; utility perceptions of the proper MAIL have declined in lock step with uranium prices. Such a development should not surprise us, for

falling prices suggest plentiful supply, which, in turn, tends to obviate any perceived need for large inventories.

Of course, the most effective means of reducing excess inventory is to cut production. The impact is immediate and direct—as production declines, more inventory must be utilized to meet consumption requirements. But, as we have come to recognize over the past 10 years, reducing production is a painful process. US uranium production peaked in 1980, with more than 20,000 people in 31 different organizations producing more than 43 million pounds equivalent U₃O₈ at 44 different facilities. Contrast this to 1989, the last year of the decade, when 2,000 people in 12 organizations produced just over 13 million pounds at 16 facilities. Many of us have long-time friends who are not here because they are no longer in the business. It is rather like a death in the family.

And who is to blame? For those seeking to vent their anger, the broker / traders represent handy and highly visible targets. Their apparent ability to grow and prosper in the current, difficult environment has clearly frustrated some producers. As a very consequence of their commercial abilities, as well as their willingness to continue to invest in the nuclear fuel business, the trading and brokerage firms have, for some, become objects of suspicion and vilification. But castigating the deal makers does not alter economic reality. Every transaction requires willing participants, and it has been my observation, during some 19 years with NUEXCO, that deals do not get done unless they make sense. The broker/traders have been and continue to serve as expert expeditors of activities *desired by the market*.

But what happens when the market sees the end of the excess inventory and prices turn up? A price reversal, real or anticipated, could, particularly if sudden or sharp, result in new thinking—that the proper MAIL should also be higher, reflecting the increasing supply risk inherent in an environment of rising prices. In this scenario, prices surge sharply higher as buyers try to increase their inventory levels even as producers, in order to match high uranium consumption rates, struggle to increase output by as much

as 50 percent. However, the prospect of a buying panic akin to that of the mid-1970s is, in my view, most unlikely, for a number of reasons:

- ◆ As noted above, estimates of future consumption now have very narrow error bands; in the 1970s, forecasts of future consumption reflected almost exponential growth, based on highly uncertain estimates of capacity additions.
- ◆ Uranium resources are now recognized as adequate to support almost any credible level of nuclear growth; such was not the case in the 1970s when there was genuine concern, in some quarters, that there might not be enough uranium to go around.
- ◆ With the advantages of considerable experience and

hindsight as well as a more predictable future, market participants are less likely to be stampeded than they were in the 1970s.

The Longer-Term Market

At the same time, however, it must be recognized that spot market developments in general and spot market prices in particular have and continue to significantly affect the longer-term market. Thus, declining spot market prices have resulted in:

- ◆ Reduced revenue from existing long-term contracts where delivery prices are keyed to the spot market. In some cases this has led to sub-economic production operations and subsequent decisions to close down.
- ◆ Lower base prices in new, non-spot market related, long-term contracts which must compete with both internal and external "buy-and-hold" strategies.
- ◆ The inability of some current and would-be producers to conclude new long-term contracts at prices, terms and conditions that will allow profitable operations.

No one should be particularly surprised that falling spot prices are forcing long-term prices lower, or that lower prices are, in fact, performing their classic economic functions of (1) forcing production cutbacks, and

No one should be particularly surprised that falling spot prices are forcing long-term prices lower, or that lower prices are, in fact, performing their classic economic functions of forcing production cutbacks, and supplanting high-cost operations with more efficient, lower-cost production.

ANALYSIS AND COMMENTARY

(2) supplanting high-cost operations with more efficient, lower-cost production. The highest cost producers, except for those enjoying the protection of high-priced contracts, were the first to close, to be followed by those with successively lower costs.

Talking about uranium prices in public forums is, at best, a risky business, and I have no wish to say anything that might, yet again, enable legions of anti-trust lawyers to enrich themselves at our collective expense. Nevertheless, I think it is safe to assert that few uranium producers can operate profitably at selling prices of \$9.00 per pound U₃O₈. Thus, and to a degree that has not existed in the past, there is now broad industry consensus that *current* spot market prices are essentially independent of the economics of uranium production. And to the extent that long-term prices are tracking down with spot prices, long-term prices have also disengaged (albeit more gradually) from economically justifiable levels. However, the willingness to admit that current price levels are inadequate to support a viable uranium supply industry in the long term, has not, for the most part, been translated into any sort of willingness to write new long-term contracts at price levels adequate to motivate or support new production ventures.

A new problem for the traditional Western producers has been the emergence of China and the Soviet Union as suppliers of natural and enriched uranium; both appear intent on and capable of carving out significant market shares for themselves. And recent political developments

around the world would certainly appear to give fresh impetus to more peaceful, less confrontational, and more interdependent economic and trading systems. Indeed, why not Bulgarian uranium? Or French conversion? Or Japanese SWU?

Conclusion

Given the liquidity of the current market, it is clear that long-term uranium prices cannot rise until spot prices begin their recovery. For the same reason, I think that interest rate considerations and arbitrage-type transactions will control the future divergence between spot and longer-term prices. Now, however, spot prices are a function of transactions involving the ongoing, and, at times, circular movement of excess inventories through the market, and, until that inventory is absorbed, no real price recovery is possible. And, unfortunately for the long-suffering producers, it appears that the only realistic way to accelerate that process is through further production cuts.

In closing I would note that the inventory build-up was an accident waiting to happen. Neither the general situation nor this particular message has changed much during the past several years. What has changed, or should have changed, is our recognition of the situation—specifically, that the rationalization of the uranium market is proving to be a longer rather than a shorter process. ■

LIABILITY IN SHIPPING RADIOACTIVE MATERIALS

The following is a slightly edited version of a presentation by Robert L. Bovey, President of NuTranS, to the USCEA Fuel Cycle '90 Conference in Nashville, Tennessee, on March 26, 1990.

This presentation primarily covers the shipment of fresh fuel materials—natural uranium concentrates and uranium hexafluoride—although lessons learned in shipping those materials may have some application to shipments of spent fuel, radioactive waste, or isotopes.

To the credit of the industry, transportation accidents have been rare and accidents involving any direct exposure of uranium cargo have been extremely rare. In over forty years, only a handful of uranium concentrate spills have occurred, and absolutely no uranium hexafluoride spills have taken place during transportation. And as a general rule, without an accident, the question of liability will not be tested.

Nonetheless, it is prudent to ask two questions about the hypothetical serious transportation accident: What would have to be paid for, and who would pay it? Among the costs that might have to be borne are those of:

- ◆ Damages to others, personal injury, or property damage;
- ◆ Cleanup and environmental restoration;
- ◆ Emergency forces actions;
- ◆ Legal fees and fines.

Potentially Liable Parties

Among the parties who might be called upon to bear some or all of these costs are the carrier, the shipper, the owner, and perhaps even the receiver of the material being transported, and, of course, their insurance companies. One may examine a set of accident scenarios and find it difficult to conceive of an accident in which the carrier would not be primarily responsible, if fault is found at all. Nevertheless, I will argue that in the current US legal environment, any party remotely connected with a shipment in which a serious transportation accident occurs can expect to be named a defendant in one or more law suits, particularly if that party represents the so-called "deep pocket." I am told that European society is not nearly so litigious; nevertheless, prudence demands that

those involved in shipments overseas also assume the need to defend themselves in the event of a serious accident.

Of the organizations represented at the USCEA Fuel Cycle '90 Conference, I doubt that many are without some exposure. And within those organizations, I expect the people at this conference will be among the first to be called into action in the extremely unlikely event of a serious transportation accident. Because the best defense is to avoid the undesirable situation in the first place, you might want to ask several questions:

- ◆ If your organization is involved in making transportation contracts or influencing them:
 - Is award of transportation contracts made on the basis of price, solely or even primarily?
 - How are potential transporters "qualified"?
- ◆ If your organization is involved even remotely in the shipment of nuclear fuel materials:
 - What instructional material is available to the workers who are actually handling your shipment on what to do under normal and under accident conditions?

Evaluating Insurance Coverage

Clearly, insurance is an important tool in reducing the level of liability exposure of your organization. There are a number of questions regarding insurance that should be addressed:

- ◆ Are we utilizing all the insurance that is readily available to us?
- ◆ Do we know what insurance is carried by our transporters, shippers, and receivers and whether it provides protection to us?
- ◆ Do any of these policies require advance notification?
- ◆ How do we allocate insurance costs?

In most cases, regardless of where your organization stands with respect to a shipment, there are ways to share insurance at little or no cost among the parties who have an interest in a particular shipment. This sharing can include, for example, other parties being named as "additional insured" on one party's insurance policy. It may be worthwhile to activate these ways, if for no other reason than to reduce the potential for bickering and confusion in the unlikely event of a serious accident.

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Some insurance policies call for the timely reporting of each shipment to the insurance company with such information as departure and arrival dates, transportation modes, cargo descriptions, etc. If an insurance policy contains such a notification requirement, after an accident is not the time to implement notification procedures. However, it is easy to fall into bad habits when nothing has ever gone wrong in a shipment in which your organization has had an interest.

The relevance of the fourth question above is less obvious than the other three. It reflects the fact that the combined effect of management performance evaluation systems and cost allocation procedures in large organizations can lead to unintended and undesirable consequences. If managers are evaluated on their cost containment performance and corporate insurance costs are allocated by some formula reflecting how much a business unit uses insurance, the result may be to discourage managers from insuring shipments.

Amount of Coverage

A major question concerning liability insurance is, How much is enough? As in the case of other questions raised here, I cannot give an answer that will apply to all organizations. However, you may want to ask, Is the coverage high enough to give the insurance company the incentive to defend your interests against all claims? In other words, Will the insurance company see the prospective legal costs as so great that its own interests would be better served by simply settling up to the limits of its policy? And, if it does so, where do you stand with respect to residual claims?

For example, if you look at a US trucker's business transportation liability policy, you may well find a combined (bodily injury and property damage) limit of liability of one million dollars, the minimum required under US law (49 CFR 387.9) for a trucker who carries feed material. Whatever number you find, you will want to ask whether it is sufficient for your circumstances.

Geographical Coverage

You also need to know if you are covered in all the places you might be exposed. For example:

- ◆ Is Canada covered?
- ◆ Are there gaps at national boundaries?
- ◆ Are there gaps at intermodal transfer points?

Because of the special and close relationship that exists between the USA and Canada, some US insurance companies treat Canada together with the US as "domestic"; but others treat Canada as "foreign." Obviously, you want to determine that whatever you are shipping in Canada—even if it is only a transit through a Canadian port—is covered somehow. If, for example, one insurance company is providing coverage inside the USA and another outside, you may ask each company what constitutes US territorial waters and airspace. Similarly, if your organization is depending, perhaps only in part, on your carriers' insurance, find out the details of the shipment plan and whose insurance covers the shipment when it is being transferred from one carrier to another.

Familiarity with Policy

Finally, I do have clear, albeit partial, answers to two important questions. The first is, how do you find out the answers to the questions above? I submit that a necessary—but unfortunately not sufficient—condition for getting answers is to read the relevant insurance policies in their entirety. On several occasions I have been told by the representative of a company that it had this or that insurance coverage, only to find upon further investigation that the desired coverage was totally absent. I am absolutely confident that these representatives were not deliberately misrepresenting the facts; they simply did not know any better.

Secondly, I would urge you to ensure that the policies have been read lately. A number of changes have been and are taking place in the structure of the insurance on which the transportation of nuclear fuel materials depends. The general trend of these changes has been to further restrict the public liability coverage afforded to industry, including coverage concerning pollution in general and coverage of radioactive cargoes. Therefore, the conventional public liability insurance you have today may not afford the same coverage that you had a year ago.

Conclusion

While the circumstances of every organization are different, all have a need to review at least periodically their posture with respect to liability during transportation of radioactive materials. If it has not been done within the last few months in your organization, I recommend you consider doing so with the appropriate professional assistance. I hope that the questions raised in this presentation will be helpful in starting the process. ■

SOUTH KOREA'S NUCLEAR FUEL INDUSTRY

March 1990 marked a major milestone for South Korea's nuclear power program, as the country became self-sufficient in nuclear fuel fabrication. The reconversion line (UF₆ to UO₂) came into full operation at the Korea Nuclear Fuel Company's fabrication plant (**Figure 1**), as the last step in South Korea's program, initiated in the mid-1970s, to localize fuel fabrication. Thus, South Korea now has the capability to produce both CANDU and pressurized water reactor (PWR) fuel assemblies.

This article covers the nuclear fuel industry in South Korea—how it is structured, its current capabilities, and its outlook for the future.

Structure of the Industry

Nuclear fuel activities are conducted for the Korea Electric Power Corporation (KEPCO) primarily by two organizations, shown in **Figure 2**. The Korea Atomic Energy Research Institute (KAERI) carries out all nuclear fuel research and development, CANDU fuel fabrication

activities, and the fuel and reactor core design activities for both CANDUs and PWRs. The Korea Nuclear Fuel Company, Ltd. (KNFC) is responsible for all PWR fuel fabrication activities.

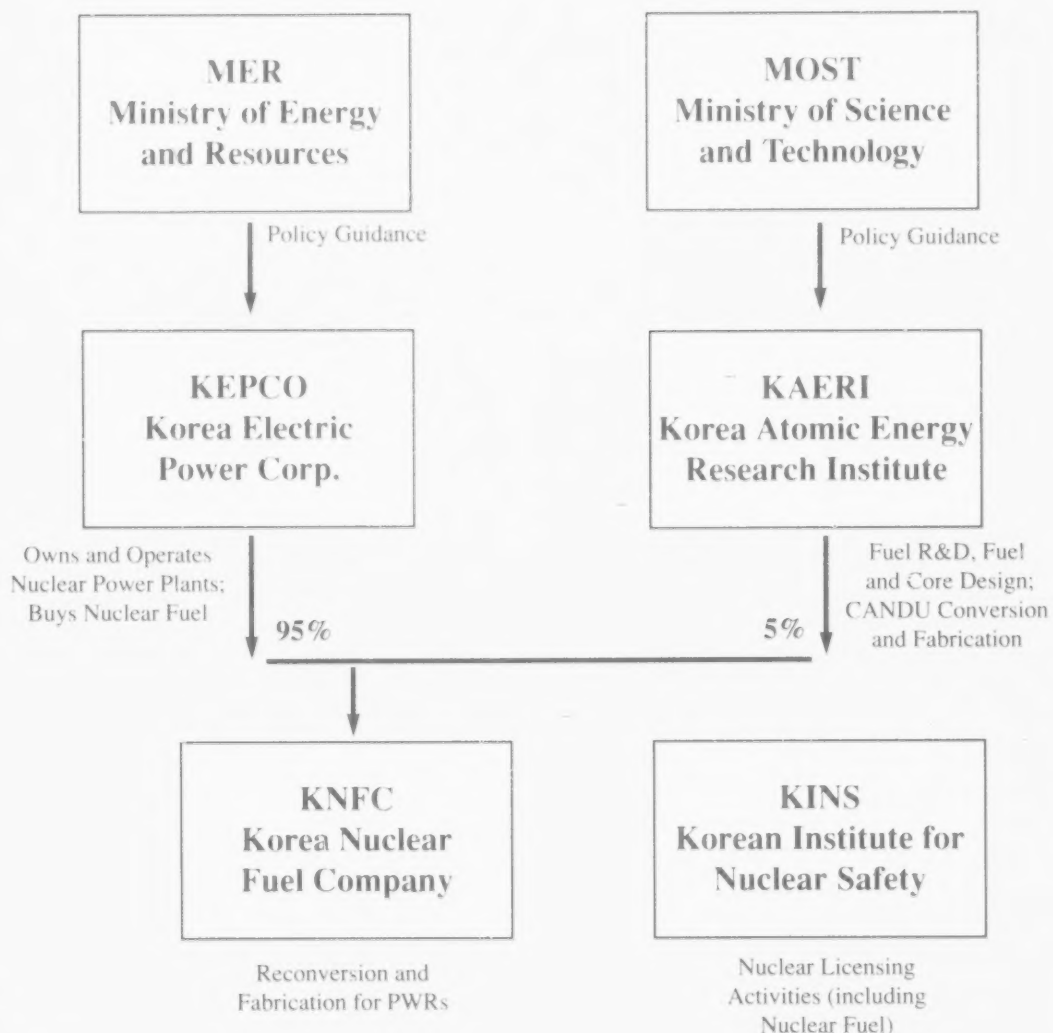
KNFC is currently owned five percent by KAERI and 95 percent by KEPCO, which is the ultimate beneficiary of KNFC's activities—that is, the user of its services. KEPCO is a state-run corporation, under the jurisdiction of the Ministry of Energy and Resources, and KEPCO is the owner and operator of all South Korea's nuclear power plants.

KAERI is an institution under the jurisdiction of the Ministry of Science and Technology. Prior to January 1990, KAERI was called the Korea Advanced Energy Research Institute, but the reorganization on January 4 spun off its nuclear licensing activities into the Korea Institute of Nuclear Safety (KINS). The new KAERI is responsible (among other things) for reactor research and development, and for reactor design activities.



Figure 1. KNFC's fuel fabrication facility at Taejeon.

Figure 2
SOUTH KOREA'S
NUCLEAR FUEL ORGANIZATIONS



All these fuel design and production activities are carried in a very integrated fashion among KEPCO, KAERI, and KNFC. In fact, the KNFC fuel fabrication plant and corporate offices are located at the same site as KAERI's facilities, at Daeduk Science Town in Taejeon.

Development of CANDU Fuel Capability

KEPCO has one CANDU-type reactor in operation (Wolsong 1) and is in the process of procuring a second unit at the Wolsong site. Even before the first commercial operation of Wolsong 1 in April 1983, KAERI had developed a pilot plant for CANDU fuel research. In 1981, the decision was made to proceed with CANDU fuel localization.

In the three-year period 1984-86, KAERI produced a total of 408 prototype CANDU fuel bundles, which were loaded into the Wolsong unit. These bundles performed well, which led to the expansion of the pilot facility to its full commercial size of 100 MTU per year, starting in January

1987. This size is more than sufficient to supply the 85-MTU-per-year needs of Wolsong 1, and this capacity can be easily expanded to meet the additional needs of Wolsong 2, scheduled to come on-line in 1997.

Through the end of 1989, KAERI has supplied over 11,000 fuel bundles for Wolsong 1. None of the discharged fuel bundles have been found to be defective, attesting to the high quality of the program.

In addition to the CANDU fuel bundle fabrication program, KAERI carried out a concentrate to UO₂ conversion development program. A laboratory scale facility of one MTU per year was built in 1983, followed by a ten-MTU-per-year pilot plant in 1984. By 1985, KAERI had brought on-line an automated powder production facility of 25 MTU annual capacity, producing material for 24 lead test bundles for Wolsong 1. The current 100 MTU-per-year plant came into commercial operation in 1988, giving South Korea full self-sufficiency in CANDU fuel production.



Figure 3. Loading of first KNFC PWR fuel assemblies for shipment to Kori-2.

FOCUS

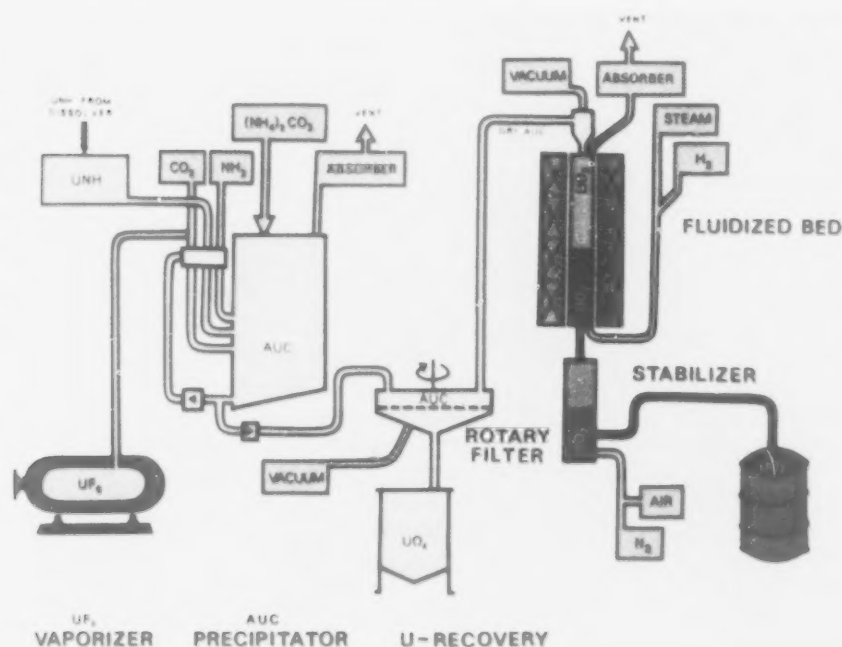


Figure 4. South Korea's AUC Reconversion Process.

Development of PWR Fuel Capability

The PWR fuel localization plan was developed by the South Korean government in 1981, leading to the formation of KNFC in November 1982. An agreement was reached with the Siemens subsidiary Kraftwerk Union (KWU) in 1985 for nuclear fuel technology transfer.

The first step of this effort was the training of KAERI engineers, who were sent to West Germany in early 1986. This led to the joint development of Korea Fuel Assemblies (KOFA). Three fuel types were developed under this effort:

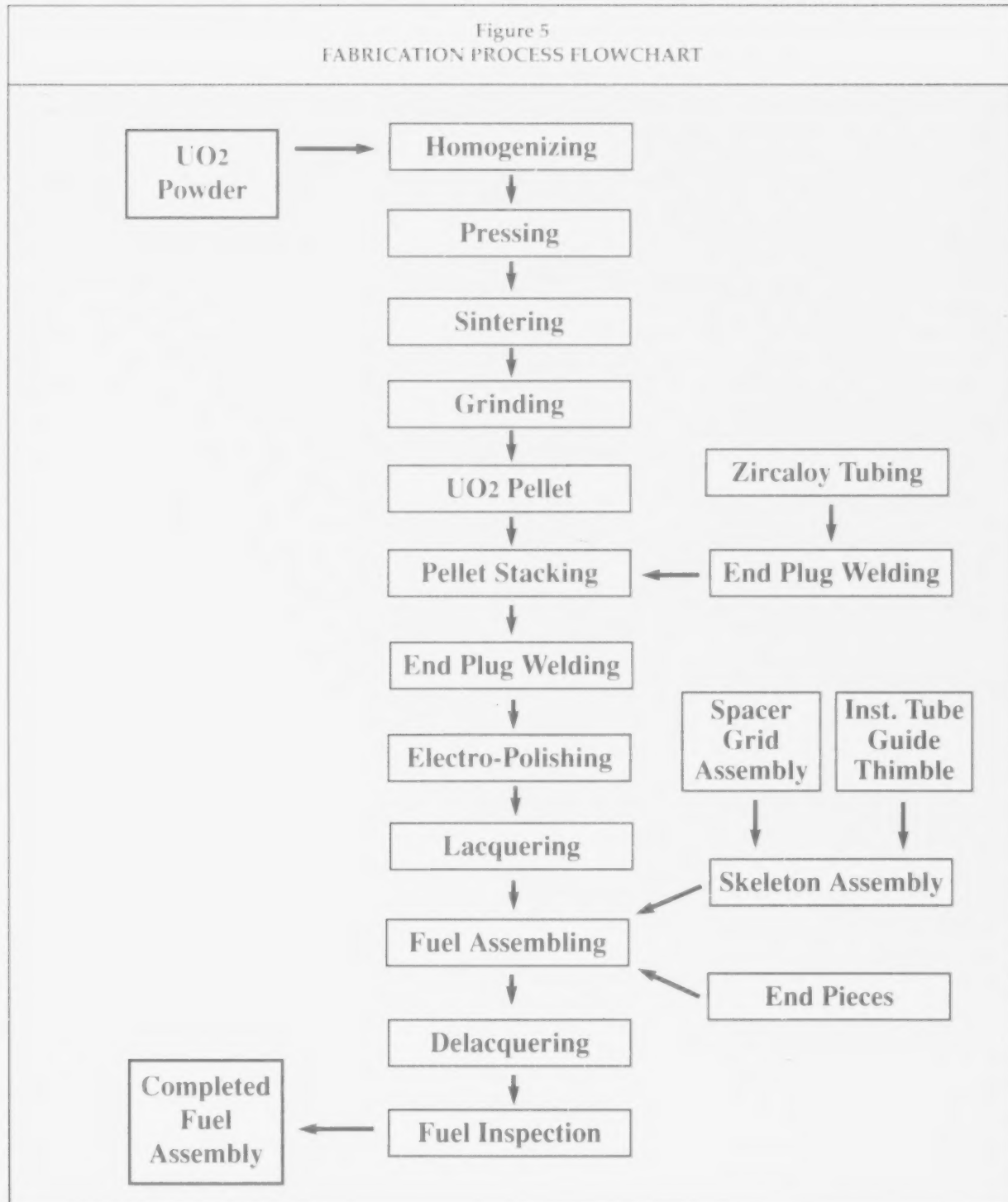
- ◆ 14x14 for the Kori Unit 1;
- ◆ 16x16 for the Kori Unit 2;
- ◆ 17x17 for the six other PWRs.

Construction on the 200-MTU-per-year fuel assembly fabrication plant at Taejon was started in November 1986, and first commercial operation of this facility was achieved

in October 1988. During this period, preliminary fuel designs for these fuel types were being developed jointly with KWU. These designs were completed in August 1988. Figure 3 shows the first assemblies produced at the plant, being loaded on trucks for shipment to Kori Unit 2. The first loadings of KNFC fabricated fuel into Kori Unit 2 were in February 1990.

In conjunction with this PWR assembly plant, the uranium reversion (UF₆ to UO₂) process used was developed by KAERI and is called the AUC Reconversion Process—AUC for Ammonium Uranyl Carbonate. This process is outlined in Figure 4. The design of this facility was started in June 1986, and construction was started in December 1987. During the period prior to startup of this reversion facility, the reversion requirements of the fuel assembly plant were supplied by the Siemens subsidiary RBU (Reaktor Brennelement Union GmbH) in West Germany. The KNFC reversion facility, as mentioned above, came into operation in March 1990.

Figure 5
FABRICATION PROCESS FLOWCHART



FOCUS

The process steps in the fuel assembly fabrication plant are shown in **Figure 5**. These steps cover the initial stage of pellet fabrication from UO₂ to final assembly and inspection. At this stage, KNFC is fully self-reliant for all the process inputs except for Zircaloy cladding tubing and for Zircaloy straps (used for assembling the spacer grids).

The fuel fabrication plant itself covers about 19.5 thousand square meters, and the 200-MTU-per-year capacity (both reconversion and assembly fabrication) is equivalent to about 450 fuel assemblies. The current load on the plant, for the eight operating PWRs of KEPCO, is about 340 fuel assemblies annually. The plant currently employs about 390 people.

PWR Fuel Assembly Design

An important element of the South Korean nuclear fuel program is technological self-sufficiency, not just manufacturing self sufficiency. To this end, South Korea is carrying out joint nuclear fuel research and development programs with its reactor vendors (Westinghouse, Framatome, Combustion Engineering, and the AECL in Canada), as well as with Siemens in West Germany. The success of this element is clear from the development of indigenous fuel designs for the KEPCO nuclear power plants.

The current design is referred to generically as the Korea Fuel Assembly, but this covers designs for the three configurations mentioned above. The heart of this KOFA concept is the 17x17 assembly, shown in **Figure 6**. This assembly has several significant differences from similar Westinghouse and Framatome offerings. The KOFA design has a thicker cladding, which should provide better mechanical integrity. In addition, the KOFA design has thicker, stronger hold-down straps.

Kori Unit 1 (using the 14x14 design) and Kori Unit 2 (using the 16x16 design) are both operating on 15-month cycles, whereas the other PWRs are on annual cycles. KEPCO is considering moving from annual cycles to 18-month cycles, and

feasibility studies for the longer cycles are being carried out now by KAERI. These studies should be completed by the second half of this year, with possible implementation of the longer cycles in the early 1990s.

In addition to KEPCO's possible shift to 18-month cycles, KAERI is actively pursuing further design evolutions—referred to as Korea Advanced Fuel Assembly (KAFA) Versions 1 and 2. KAFA-1 is being developed for the 17x17 configuration, since most of KEPCO's PWRs use this configuration. The KAFA-1 concepts could be applied to the other two (14x14 and 16x16) configurations later. The advanced features of KAFA-1 are compared to the KOFA design in **Table 1**. As the table shows, the improvements are in discharge burnup, the use of axial blankets, mixing vanes in spacer grids, and debris resistance features.

Table 1
ADVANCED FEATURES OF KOFA-1 COMPARED TO KAFA
(17x17 Type)

Content	KOFA ¹	KAFA ²	Remarks
Discharge Burn-up (MWD/MTU)	38,000	43,000	• 14% Increase in Discharge Burn-up • 7% Reduction in Total Fuel Cycle Cost
Use of Axial Blanket	No	Yes	• Improvement of Neutron Economy • 3% Reduction in Total Fuel Cycle Cost
Use of Mixing Vane in Spacer Grids	No	Yes	• Improvement of Thermal Performance • Improvement of Safety and Operational Margin
Use of Debris Resistant Feature	No	Yes	• Enhancement of Fuel Mechanical Integrity

¹ KOFA: Korea Fuel Assembly

² KAFA: Korea Advanced Fuel Assembly

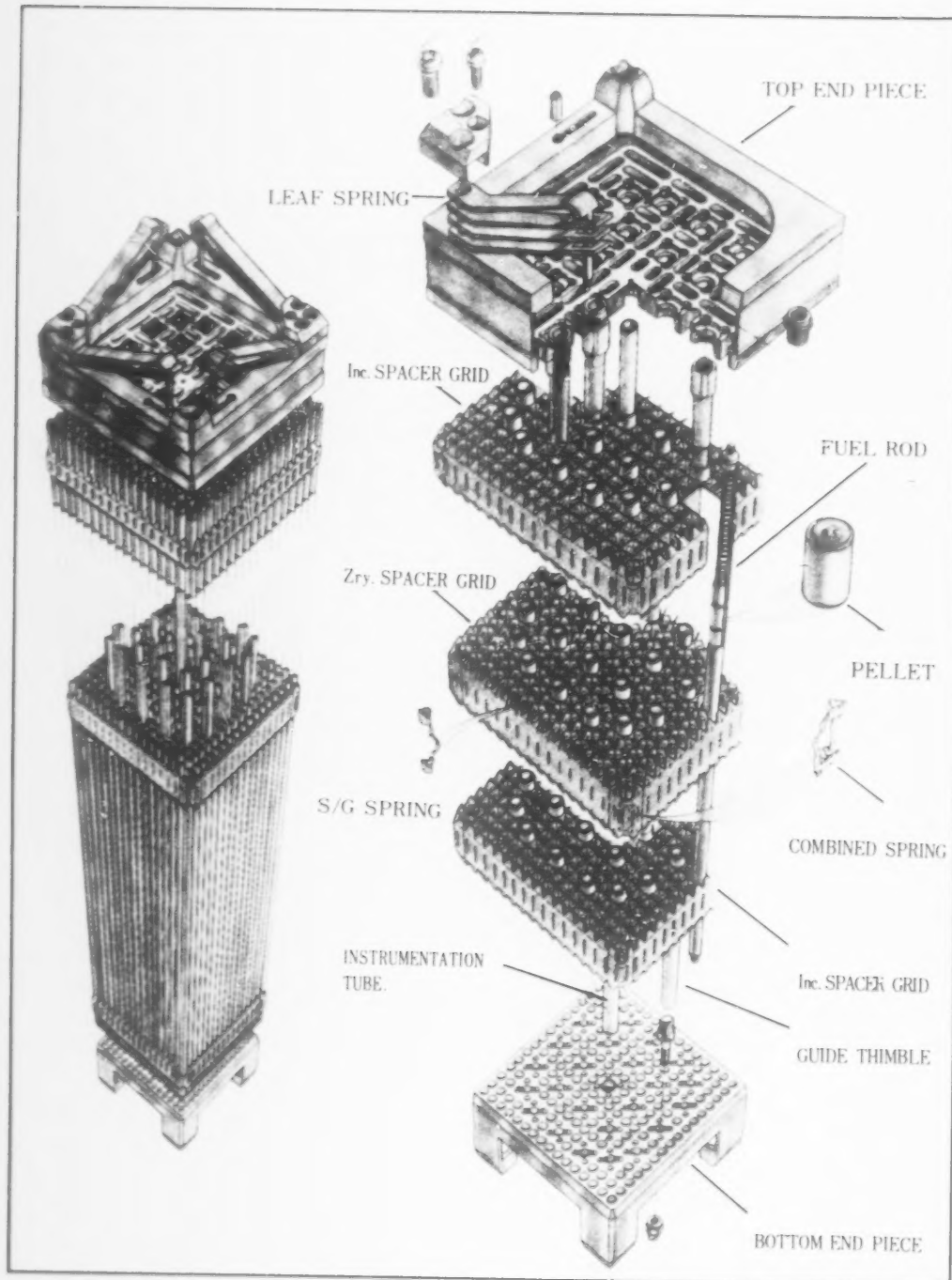


Figure 6. 17x17 Type Korea Fuel Assembly.

FOCUS

All analyses relating to KAFA-1 should be completed by the end of 1993, followed by submission of a Fuel Design Report to the KINS in 1994. Licensing of the KAFA-1 would then be expected by the end of 1995, with implementation starting in 1996.

The KAFA-2 design will depend on the results of KAERI research and development of cladding materials and fuel pellets for even higher burnup. Thus, exact specifications are not yet available. However, the major development activities for KAFA-2 are expected to commence in 1995, with the first assemblies being supplied to KEPCO as early as the year 2001.

KEPCO, as the ultimate user of KAERI's fuel design services, has expressed dissatisfaction that the schedule for developing these advanced fuel schemes lags the "state of the art," as established by non-Korean fabricators. Whether an advancement of these schedules will occur is uncertain, but the pressure to do so is clear.

In addition to the advancement of PWR fuel designs, KAERI is also pursuing research and development of advanced CANDU fuel bundles. This new bundle design is expected by 1997.

Conclusions

South Korea's rapid industrialization and near-miraculous economic growth in the past two decades would not have been possible without the important contribution of nuclear power to meeting South Korea's electricity requirements. Because of its strong commitment to nuclear power, KEPCO has been able to keep up with double-digit growth in electricity demand at reasonable costs. Consequently, nuclear power now accounts for half of South Korea's electricity production—among the highest percentages in the world.

It seems clear to South Korea's policy makers that nuclear power must continue to play a key role in its economic development. Security of supply is a major consideration in South Korea's commitment to nuclear power; thus, it is quite appropriate that South Korea has vigorously pursued a goal of self-sufficiency in nuclear fuel fabrication—both in design and in fabrication. The culmination of this goal in March 1990 is a tribute to South Korea's foresight and determination. ■

Dr. R. Gene Clark

Nuclear Industry Calendar**1990**

- Apr. 8-12** *First Annual International High-Level Radioactive Waste Management Conference* (Caesar's Palace Hotel, Las Vegas, Nevada), sponsored by the American Nuclear Society and American Society of Civil Engineers. Contact the ANS at Meetings Department at 1-312-352-6611.
- Apr. 9-11** *23rd JAIF Annual Conference* (Kyoto, Japan). Contact Ms. Sachie Sugoh, Dept. of Planning and International Affairs, JAIF, at 03-508-9056.
- Apr. 22-25** *INFO '90* (Westin Hotel, Dallas, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.
- Apr. 23-27** *1st Regional Seminar for the Middle East and Europe on Management of Quality for Nuclear Power Projects* (Prague, Czechoslovakia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400, Vienna, Austria.
- May 15-17** *Annual Meeting on Nuclear Technology 90* (Nuremburg, FR Germany). Contact Deutsches Atomforum e.V., Conference Office JK 90 at 0228 507223.
- May 21-23** *1990 Nuclear Power Assembly* (Washington, DC). Contact American Nuclear Energy Council at 1-202-484-2670.
- June 3-7** *30th Annual Conference of the Canadian Nuclear Association and 11th Annual Conference of the Candian Nuclear Society* (Toronto, Canada). Contact Canadian Nuclear Association, 111 Elizabeth Street, Toronto, Ontario, Canada M5G 1P7.
- June 4-8** *International Symposium on Nuclear Techniques in Exploration and Exploitation of Energy and Mineral Resources* (Moscow, USSR). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.
- June 10-15** *American Nuclear Society Annual Meeting* (Nashville, Tennessee). Contact American Nuclear Society at 1-708-352-6611.
- Sept. 4-7** *International Seminar on the Costs and Financing of Nuclear Power in Developing Countries* (Jakarta, Indonesia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.
- Sept. 5-7** *Uranium Institute 15th Annual Symposium* (London, United Kingdom). Contact the UI at 44-1-225-0308.
- Sept. 16-19** *Uranium Seminar '90* (Hyatt Regency, San Antonio, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.

CALENDAR

**Nuclear Industry Calendar
(continued)**

1990

- Sept. 23-28 *ENC '90 Congress & Exhibition* (Lyon, France) organized by the European Nuclear Society in collaboration with the ANS and Foratom. Contact Dr. P. Feuz, European Nuclear Society at 31-21 61 11.
- Oct. 14-16 *World Nuclear Fuel Market Annual Meeting* (Toulouse, France). Contact Donna Cason at 1-404-447-1144.
- Nov. 11-14 *Nuclear Energy Forum* (Washington Hilton, Washington, D.C.), sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611.

1991

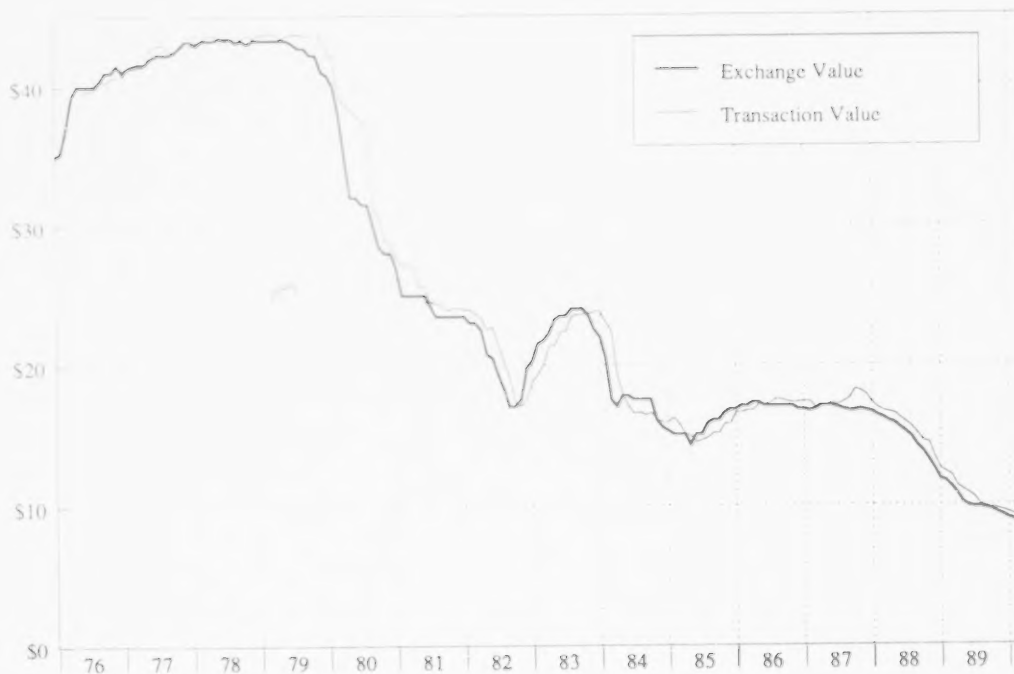
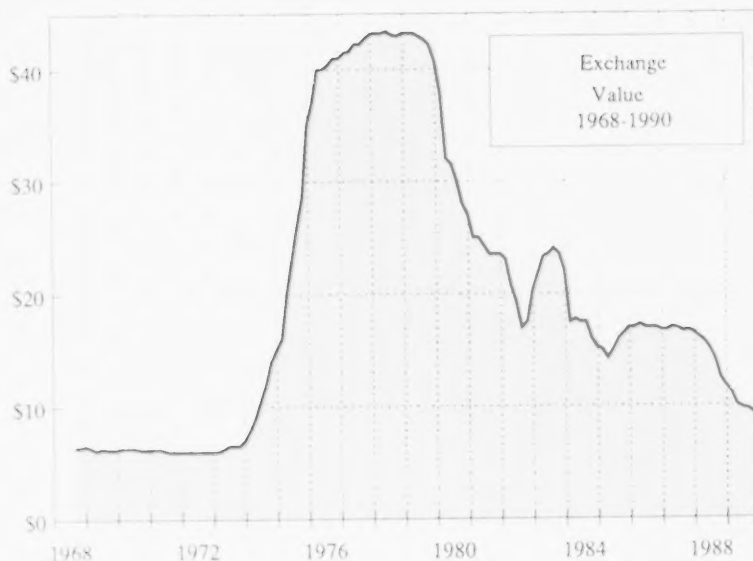
- May *Second International Conference on Transportation for the Nuclear Industry* (Bournemouth, England). Contact The Conference Secretary, The Institution of Nuclear Engineers at 01-698 1500. After May 6, 1990, the number will be 081-698 1500.

HISTORICAL MARKET DATA

**NUEXCO Historical
Exchange and
Transaction Values**

(In US Dollars/Pound U_3O_8)

30 20 10 0





HISTORICAL MARKET DATA

HISTORICAL MARKET VALUES

EXCHANGE VALUES												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85	8.70	8.80									

US PREMIUM (Relative to the Exchange Value)												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	Discontinued	

HISTORICAL MARKET DATA

UF6 VALUES Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90	25.25	24.40									

US UF6 PREMIUM (Relative to the UF6 Value) Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	Discontinued	

TRANSACTION VALUES Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25	9.05	8.75									



HISTORICAL MARKET DATA

LOAN RATES

Determined as of the last day of the month indicated (Percent per Annum)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50	3.50	3.50									

* Float with Prime Rate

CONVERSION VALUES

Determined as of the last day of the month indicated (\$US/lb U as UF6)

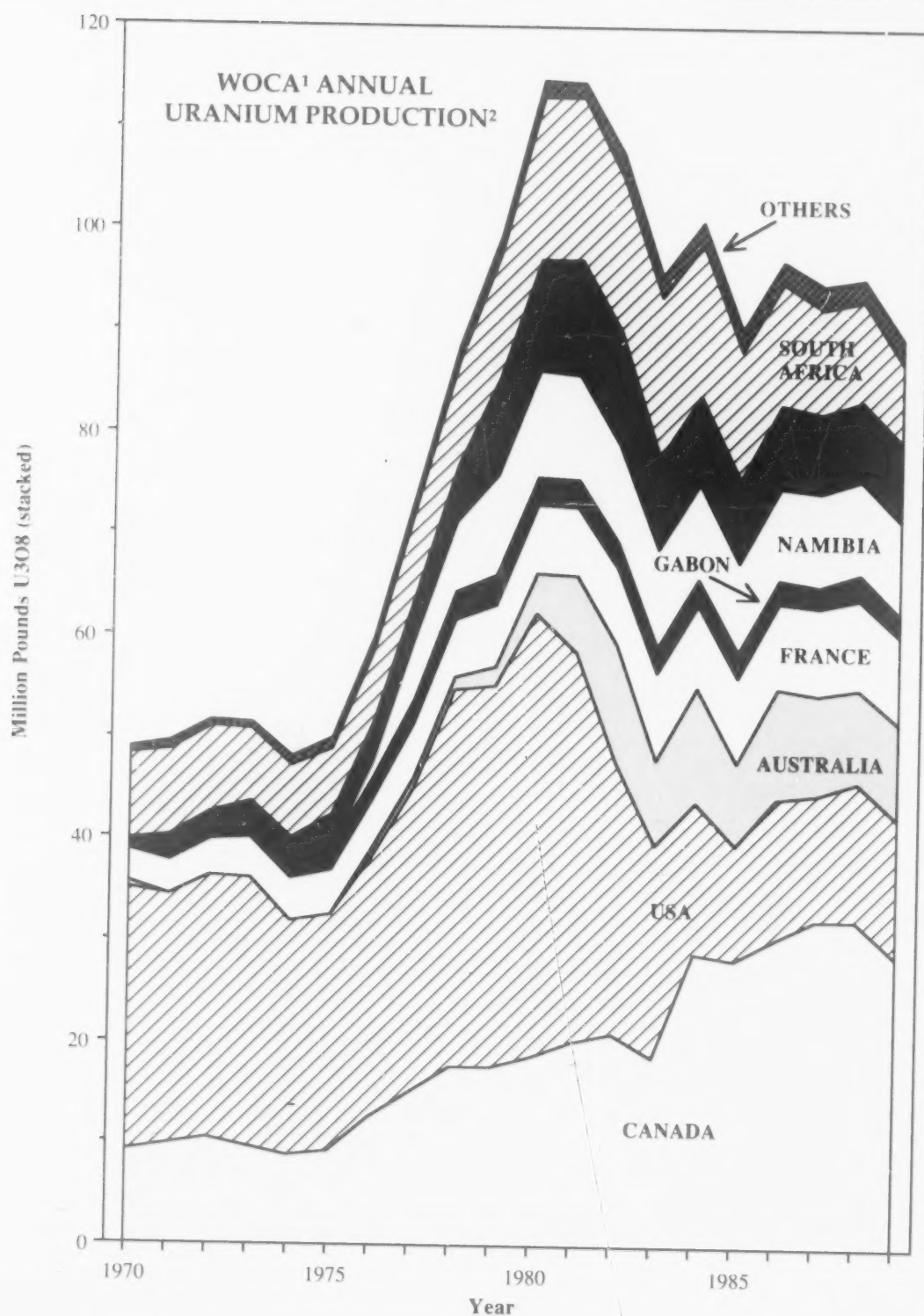
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.50	1.50	1.45									

SWU VALUES

Determined as of the last day of the month indicated (\$US per SWU)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54	50	50									

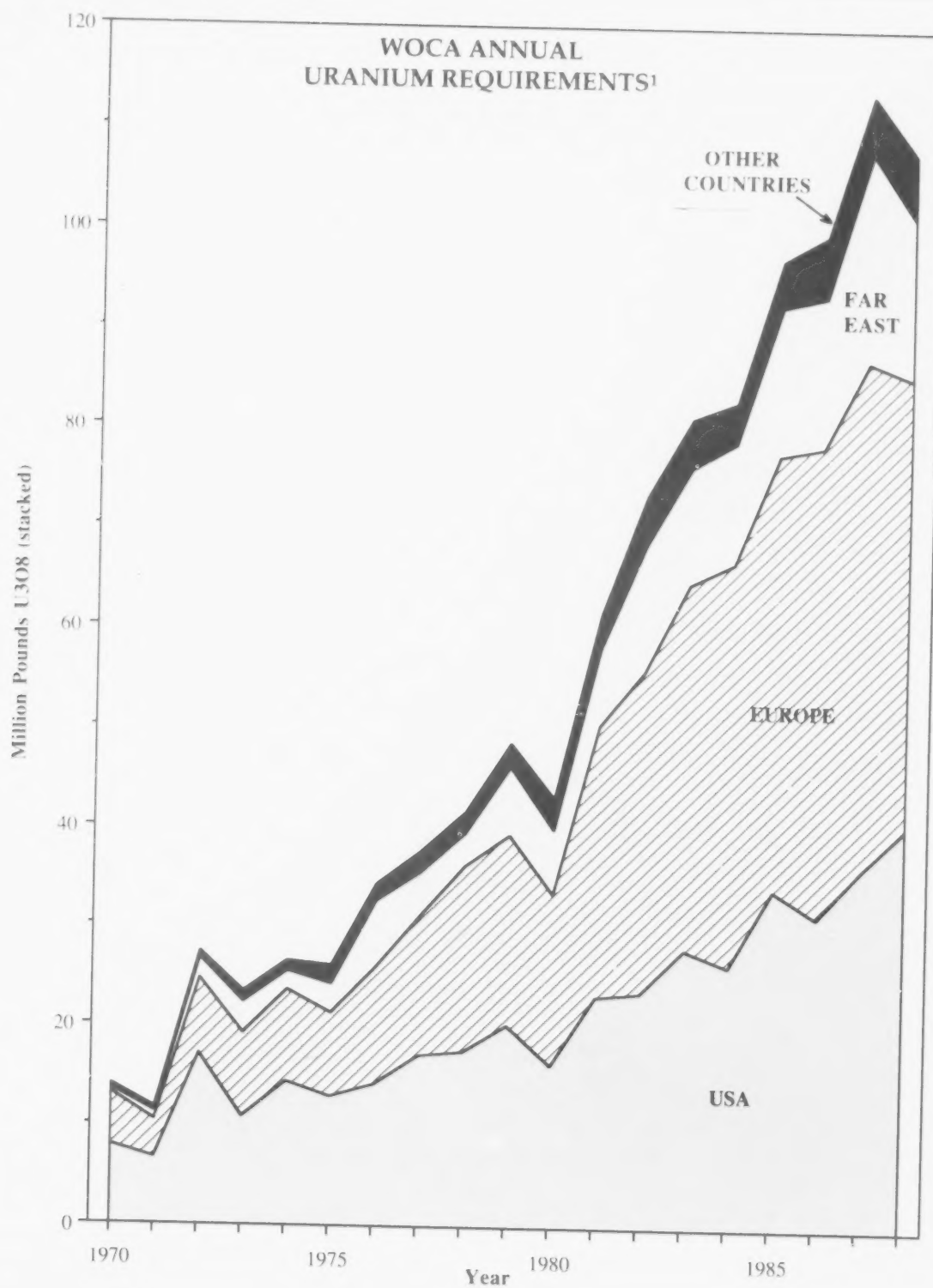
HISTORICAL MARKET DATA



¹ WOCA = World Outside of Centrally-Planned Economic Areas.

² Estimated world production in 1989 totalled 89.6 million pounds (Australia—9.5; Canada—28.7; France—8.5; Gabon—2.2; Namibia—9.2; Niger—7.7; South Africa—7.7; USA—13.7; Other—2.3).

HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual plant completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

GOVERNMENT STATISTICS

AUSTRALIA

		Consumer Price Index ¹ (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ² (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia (Australian dollars) ³	Award Rates of Pay Indexes: Australia — Adult Males In Mining Wage Earners, Weekly Rates ⁴ (June 1985 = 100)
1980	Avg.	95.8	83.1	—	140.8
1981	Avg.	105.0	85.9	—	154.0
1982	Avg.	116.7	89.0	—	174.9
1983	Avg.	128.5	96.9	—	181.9
1984	Avg.	133.6	98.0	—	194.4
1985	Avg.	142.6	107.3	—	117.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.1
1988	Avg.	180.9	111.8	496.90	115.2
Jan	1989	—	110.6	—	122.2
Feb	1989	—	111.2	521.90	122.2
Mar	1989	188.0	114.9	—	123.1
Apr	1989	—	117.5	—	123.2
May	1989	—	118.6	530.40	123.7
June	1989	192.6	119.9	—	124.7
July	1989	—	120.1	—	126.2
Aug	1989	—	119.2	539.30	126.2
Sept	1989	197.0	117.7	—	126.1
Oct	1989	—	117.8	—	126.5
Nov	1989	—	118.0	547.20	126.8
Dec	1989	—	118.2	—	126.8
Jan	1990	—	119.2	—	126.8

P = Preliminary R = Revised since last month

¹Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 = 100.0). Figures shown at end of quarter represent quarterly average.

²Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

³Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

⁴Monthly data for the period 1967 to 1986 appear in Report 233.

⁵Base: June 1976 = 100.

⁶Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

GOVERNMENT STATISTICS

CANADA								
Wage-earner Data: Average Hourly Earnings (C\$) ²								
		Industrial Products Price Index: All Commodities ¹ (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells ³ (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	138.2	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	143.8	20.91	18.51	16.95	13.17	13.77
Jan	1989	130.7	146.8	21.22	19.45	18.14	13.75	13.82
Feb	1989	130.8	147.8	22.05	19.51	18.26	13.79	13.89
Mar	1989	131.3	148.5	21.90	19.65	18.35	13.62	14.10
Apr	1989	131.3	149.0	22.37	19.80	18.40	13.57	14.16
May	1989	131.4	150.5	21.89	20.02	18.17	13.76	14.27
June	1989	131.5	151.3	21.89	20.02	18.17	13.76	13.22
July	1989	131.4	152.3	21.67	19.60	17.96	13.57	12.98
Aug	1989	131.3	152.4	20.97	19.76	18.24	13.52	14.30
Sept	1989	131.0	152.6	21.97	20.61	18.73	13.68	14.83
Oct	1989	130.8	153.2	22.26	20.71	18.74	13.99	14.77
Nov	1989	130.6	153.7	22.60	20.64	18.78	13.93	14.75
Dec	1989	130.2	153.6	22.80	20.50R	18.93R	13.62R	14.77R
Jan	1990	130.4	154.9	21.88P	20.37P	19.01P	13.99P	14.85P
Feb	1990	131.3	155.8	—	—	—	—	—

P = Preliminary R = Revised since last month

¹Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

²Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

³Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

HISTORICAL MARKET DATA
REPUBLIC OF SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand) ¹	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100) ²	Consumer Price Index ³ (1985 = 100)	Production Price Index All Groups ⁴ (1985 = 100)	Total Employment in Mining and Quarrying ⁵	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) ⁵
1980	Avg.	35.53	—	51.9	55.2	709,042	2,237,689
1981	Avg.	41.89	—	59.8	62.7	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	71.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	79.0	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	85.6	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	100.0	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	119.5	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	136.2	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	154.1	705,355	7,774,054
Jan	1989	—	—	166.8	165.5	714,593	704,320
Feb	1989	—	—	168.2	168.5	696,329	669,983
Mar	1989	112.29	262.8	170.9	171.1	702,746	695,843
Apr	1989	—	—	173.1	173.8	658,677	634,344
May	1989	—	—	175.9	176.4	706,056	721,263
June	1989	113.76	267.0	177.7	177.1	706,810	720,586
July	1989	—	—	179.3	178.8	711,648	775,002
Aug	1989	—	—	181.8	180.7	703,812	793,475
Sept	1989	119.76	280.2	183.4	181.7	708,222	780,723
Oct	1989	—	—	185.1	183.9	689,017	—
Nov	1989	—	—	187.0	185.6	—	—
Dec	1989	120.79	282.0	189.4	187.2	—	—
Jan	1990	—	—	192.0	188.8	—	—
Feb	1990	—	—	193.3	—	—	—

P = Preliminary R = Revised since last month

¹Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

²Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

³Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 236.

⁴Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

⁵Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

HISTORICAL MARKET DATA

UNITED STATES									
		Producer Price Index ¹		Consumer Price Index ²	GNP Implicit Price Deflator ³	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
Jan	1989	109.4	110.5	121.1	—	13.80	13.49	12.85	10.27
Feb	1989	110.1	110.8	121.6	—	13.66	13.48	12.88	10.26
Mar	1989	110.5	111.5	122.3	125.4	13.71	13.51	12.91	10.30
Apr	1989	111.8	112.3	123.1	—	13.68	13.65	12.92	10.31
May	1989	112.1	113.2	123.8	—	13.60	13.57	12.98	10.33
June	1989	112.4	112.9	124.1	126.0	13.62	13.66	12.98	10.37
July	1989	112.2	112.8	124.4	—	13.70	13.75	13.12	10.41
Aug	1989	111.4	112.0	124.6	—	13.64	13.72	13.08	10.40
Sept	1989	111.9	112.4	125.0	126.8	13.70	13.99	13.18	10.47
Oct	1989	112.4	112.8R	125.6	—	13.76	13.94	13.25	10.43
Nov	1989	112.2	112.7	125.9	—	13.69	14.12	13.26	10.47
Dec	1989	112.3	113.0	126.1	128.0	13.51R	14.16R	13.31	10.52
Jan	1990	114.2	114.9	127.4	—	13.71P	13.96P	13.32R	10.51R
Feb	1990	113.6	114.4	128.0	—	—	—	13.24P	10.56P

P = Preliminary R = Revised since last month

¹US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

²US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

³US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

⁴US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

GOVERNMENT STATISTICS

**VOLUME AND PRICE OF URANIUM DELIVERIES
TO THE EUROPEAN COMMUNITY¹**
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC ² (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ^{3,4}		Spot Contracts ^{3,4}	
			Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈	Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,500	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65R	\$16.13R

R = Revised

¹The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

²The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

⁴Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

GOVERNMENT STATISTICS

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	\$16.10	3.6	n/a	1.2
1977	29.9	27.8	\$19.75	5.6	n/a	4.0
1978	37.0	31.6	\$21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agents

³ Includes imports by domestic utilities and domestic suppliers

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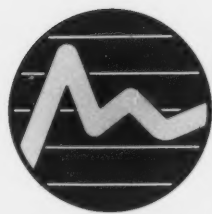
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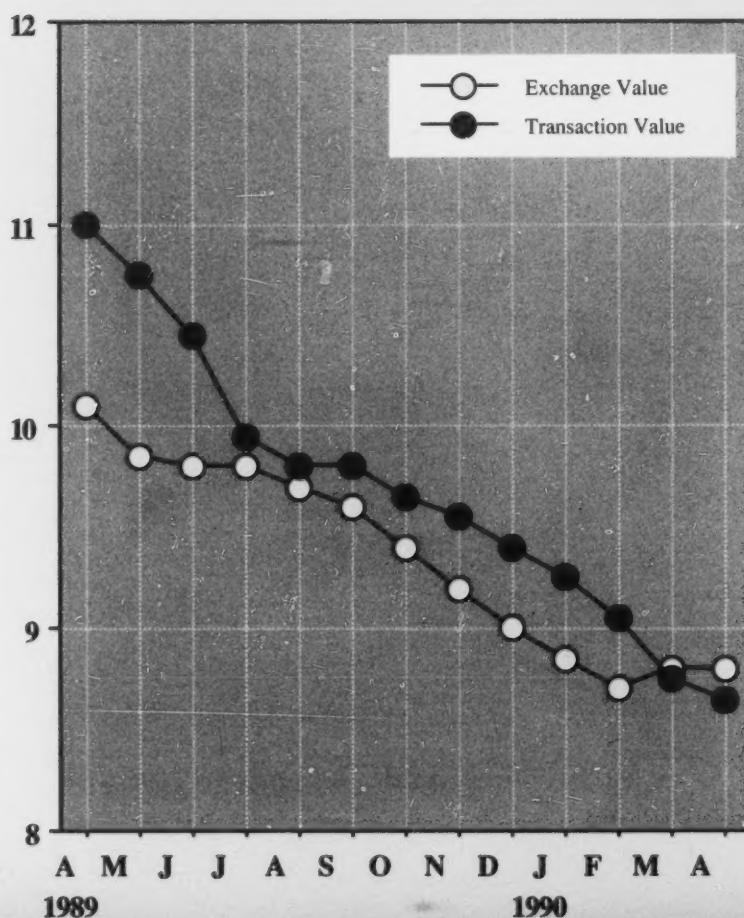
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International Atomic Energy Agency 24





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NUEXCO MONTHLY REPORT

May 1990, No. 261

* * *

EXECUTIVE SUMMARY

(As of April 30, 1990)

Exchange Value
\$8.80, unchanged

The **Exchange Value** is **\$8.80** per pound U_3O_8 , unchanged from March 31.

UF₆ Value
\$24.40, unchanged

The **UF₆ Value** is **\$24.40** per kg U as UF₆, unchanged from the March 31 UF₆ Value.

**Uranium Sales;
Supply and
Demand**

Thirteen April uranium sales involved **4.8 million** pounds equivalent U_3O_8 . All 13 of these sales involved spot or near-term delivery and met the conditions for inclusion in the Transaction Value. Active spot and near-term **uranium supply** amounts to **1.3 million** pounds equivalent U_3O_8 , down from 3.8 million pounds at the end of March. Active spot and near-term **uranium demand** totals **4.6 million** pounds, up from 4.5 million pounds on March 31. The spot and near-term **supply-demand ratio** is **0.3 to 1**, down from the March 31 figure of 0.9 to 1.

Transaction Value
\$8.65, down \$0.10

The **Transaction Value** is **\$8.65** per pound U_3O_8 , down \$0.10 from March 31. The calculation includes 24 transactions over a period of three months involving a total of 8.4 million pounds equivalent U_3O_8 .

Loan Rate
3.5%, unchanged

The **Loan Rate** remains at **3.5 percent** per annum, and six current natural uranium loans are reported involving over 2.5 million pounds equivalent U_3O_8 .

Conversion Value
\$1.45, unchanged

The **Conversion Value** is **\$1.45** per pound U as UF₆, unchanged from March 31. One transaction for conversion services is reported.

SWU Value
\$50, unchanged

The **SWU Value** remained at **\$50** per SWU, and no SWU sales are reported. Active supply is down from 345 to 145 thousand SWU, and active demand increased from 95 thousand to 1.9 million SWU.

* * *

**The Economic Future
of the US Uranium
Industry**

The US uranium industry is no longer the world leader it was only a decade ago. A speech presented by NUEXCO's Thomas C. Pool to the US Geological Survey analyzes the US uranium industry and how it relates to future levels of exploration, production, and employment.

**International Atomic
Energy Agency**

The International Atomic Energy Agency (IAEA) is perhaps best known for its nuclear material safeguarding system, but for more than 30 years it has been a leading international authority on all applications of nuclear energy. It is the preeminent organization for advancing peaceful uses of atomic power.

NUEXCO MONTHLY REPORT 261 FIGURES OF THE MONTH (April 30, 1990)	This Month (Report 261)	Last Month (Report 260)	12 Months Ago (Report 249)
Exchange Value (\$US per pound equivalent U ₃ O ₈)	8.80	8.80	10.10
UF₆ Value (\$US per kg U as UF ₆)	24.40	24.40	30.50
Transaction Value (\$US per pound equivalent U ₃ O ₈)	8.65	8.75	11.00
Loan Rate (Per Annum)	3.5%	3.5%	3.5%
Conversion Value (\$US per pound U as UF ₆)	1.45	1.45	1.95
Near-Term Uranium Supply ¹ (million pounds equivalent U ₃ O ₈)	1.3	3.8	4.8
Near-Term Uranium Demand ² (million pounds equivalent U ₃ O ₈)	4.6	4.5	1.3
Near-Term Supply-Demand Ratio	0.3	0.9	3.8
Recent Uranium Sales: ³			
Number of Transactions	14	8	15
Quantity of Material (Million pounds equivalent U ₃ O ₈)	7.5	5.2	6.0
Nuexco SWU Value: (\$US per SWU) at 0.3 tails assay	50	50	67
US DOE SWU Prices: (\$US per SWU)			
USEC	117.85 ⁴	117.85 ⁴	117.00 ⁵
AFC	153.00 ⁶	153.00 ⁶	153.00 ⁶
Requirements	157.00 ⁶	157.00 ⁶	157.00 ⁶
Incentive Price (IP1)	90.00 ⁷	90.00 ⁷	90.00 ⁷
Market Value of Enriched UF₆ ⁸ : (\$US per kg U as UF ₆)			
2.5 w/o U ₂₃₅	267	267	334
3.0 w/o U ₂₃₅	343	343	431
3.5 w/o U ₂₃₅	421	421	530
4.0 w/o U ₂₃₅	500	500	630

¹ Active inquiries to sell, for delivery within 12 months measured from the date of this Report.

² Active inquiries to purchase, for delivery within 12 months measured from the date of this Report.

³ Uranium sales only; does not include loans, conversion, or SWU transactions.

⁴ Effective 10/1/89 to 9/31/90.

⁵ Effective from 10/1/87 to 9/31/89.

⁶ Effective since 10/1/84.

⁷ Effective from 10/1/86 to 9/31/90, for up to 30% of annual requirements. DOE chose to waive application of the GNP deflator for FY87-FY90 deliveries.

⁸ Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 percent tails assay.

NUEXCO

Monthly Report

May 1990
No. 261

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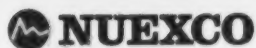
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Market Study; International
Directory of Nuclear Utilities
(IDNU), International Directory
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To Our Readers

We are pleased to announce two personnel reassignments. Effective May 1, 1990, Charles H. Peterson, President of NUEXCO International Corporation and of NUEXCO Information Services, became Vice-Chairman – International Business Affairs for NUEXCO's parent organization, CONCORD. He will also assume the duties of President and Chief Operating Officer of CONCORD Trading Corporation, a company engaged in international trading on a broad basis. Chuck will transfer to our Washington D.C. office, to better develop CONCORD's trading business and to interact with CONCORD's offices throughout the world.

Earl E. Hoellen will assume additional responsibilities and lead CONCORD's nuclear fuel cycle activities as President and Chief Operating Officer of NUEXCO. Earl will continue to head NUEXCO Trading Corporation, while taking on responsibility for all NUEXCO information and fuel cycle services.

These adjustments will enable CONCORD/NUEXCO to more readily adapt to worldwide market changes and pursue growth opportunities, while maintaining coordination of the various functional areas of NUEXCO.

MARKET VALUES SUMMARY

April 30, 1990

Market Values	This Month (Report 261)	Active Supply* (thousand pounds equivalent U ₃ O ₈)	Active Demand* (thousand pounds equivalent U ₃ O ₈)
EXCHANGE VALUE¹	\$8.80/lb U₃O₈		
UF₆ VALUE²	\$24.40/kg U as UF₆	1,300**	4,610**
LOAN RATE³	3.5%/annum	7,170	0
CONVERSION VALUE⁴	\$1.45/lb U as UF₆	150	1,490
SWU VALUE⁵ 0.3 tails assay:	\$50/SWU	145	1,890
TRANSACTION VALUE⁶	\$8.65 Per Pound U ₃ O ₈	24 Transactions	3 Months
			8.4 Million Pounds

* Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

** Includes uranium concentrates and uranium hexafluoride.

DEFINITIONS

¹ The **Exchange Value** is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

² The **UF₆ Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

³ The **Loan Rate** is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

⁴ The **Conversion Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

⁵ The **SWU Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

⁶ The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
a. Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
b. At least ten transactions;
c. Transactions involving a sum total of at least 2 million pounds U₃O₈ equivalent.

DERIVATIONS AND COMMENTS

- All **Market Values** are based on:
- Data from recently completed transactions.
- Data from pending transactions.
- Firm bids to buy or borrow, and firm offers to sell or lend.
- Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend.

- Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these **Market Values**.

- In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers.

- The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.

- For the **SWU Value**, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the NUEXCO **Exchange Value** and **Conversion Value** determined as of the same date.

- In calculating the **Transaction Value**, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future **Exchange Values** or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined.

- The sample time for the **Transaction Value** is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

PRICING

APRIL MARKET REVIEW

(as of April 30, 1990)

NATURAL URANIUM AND CONVERSION

Short-term Market Activity

After an active month, all of the April 30 NUEXCO Market Values remained unchanged from their March 31 levels, except for the Transaction Value. Market activity throughout the month demonstrated that both buyers and sellers were unusually uncertain of market direction. Almost five million pounds equivalent U₃O₈ changed hands during April in thirteen near-term natural uranium sales. Eight concentrate sales included nearly three million pounds, while five UF₆ sales accounted for the balance of the near-term natural uranium market volume.

The April 30 Exchange Value held at \$8.80 per pound U₃O₈, and the eight near-term concentrates sales occurred at prices near that level. Sellers found the European concentrates market especially difficult because demand was relatively low. In order to elicit interest, sellers offered prices well below the Exchange Value, but even then few sales resulted because of the competitive advantage of purchasing UF₆. In contrast, demand for concentrates remained high in North America, though supply from traditional and unexpected sources has been adequate to preclude a further price rise. Producers continued their non-traditional role, appearing as buyers in five of the eight concentrate sales.

For the first time in seven months the UF₆ Value did not decline, remaining at \$24.40 per KgU as UF₆. The large oversupply that has characterized the UF₆ market in recent months has diminished, enough that the market imbalance that had been driving the price decline for the past 28 months has subsided, at least temporarily. Five natural UF₆ sales, totalling nearly two million pounds equivalent U₃O₈, took place at prices that varied widely both above and below the April 30 UF₆ Value. The prevailing market uncertainty led to deals being concluded with an

unaccustomed variety of commercial terms, special considerations, and price levels. Some of the offers below the UF₆ Value contained other financial considerations which resulted in a higher evaluated price.

Nonetheless, sellers still appear to have ample material available and are prepared to compete aggressively, especially for sales to utilities. In each of the five April natural UF₆ sales the seller was an intermediary. In contrast to recent months, no enriched uranium product (EUP) transactions are reported.

* * *

The Transaction Value declined to \$8.65 per pound U₃O₈ based on 24 transactions over 3 months involving 8.4 million pounds. The Transaction Value is calculated using a weighted moving average of recent natural uranium sales, including both concentrates and UF₆. This three-month time period includes the lower priced sales from February and March, and is one reason the Transaction Value continued to decline. However, the primary reason for its decline is the discrepancy between the UF₆ Value and the sum of the values of its component parts. If calculated using the April 30 Exchange Value (\$8.80) and Conversion Value (\$1.45), the UF₆ Value would have been \$26.19 per KgU as UF₆. However, under current conditions, the market assesses UF₆ at a substantially lower level, so the UF₆ Value is only \$24.40 per KgU as UF₆ (not a calculated figure). Thus, the market is valuing UF₆ at a discount of \$1.79 per KgU, relative to the combined worth of its components.

To calculate the Transaction Value, NUEXCO uses a volume-weighted average of both concentrate sales and the U₃O₈ component of UF₆ sales for three months (or more). In determining the effective price of the U₃O₈ component in a UF₆ sale, NUEXCO uses the UF₆ price of that particular sale and the current Conversion Value to derive the price for the U₃O₈ component to be used in the Transaction Value calculation. However, under current market conditions, that method yields low effective prices for the U₃O₈ component of UF₆ sales. For example, if a UF₆ sale was concluded at \$25.00 per KgU as UF₆, using the April 30 Conversion Value of \$1.45 per pound U as

UF₆ would yield an effective price for the U₃O₈ component of only \$8.34 per pound U₃O₈.

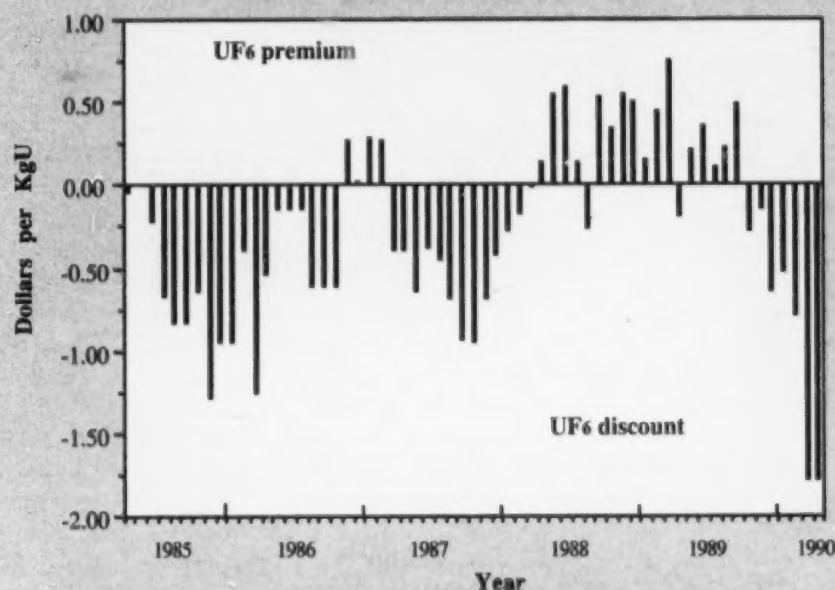
Given the current oversupply of UF₆ and resulting low-priced UF₆ sales, this approach can reduce the Transaction Value below the Exchange Value. The recent high volume of natural UF₆ sales accentuates this effect. However, under other circumstances, the market could be valuing UF₆ at a premium over its component parts, in which case the UF₆ sales included in the Transaction Value calculation would tend to hold the Transaction Value above the Exchange Value.

Figure 1 shows that variations between the UF₆ Value and the sum of its component values $[(EV \times 2.61284) + (CV \times 2.20462)]$ are the rule rather than the exception. The \$1.79 per KgU discount at which UF₆ was valued on April 30 is simply a continuation of the trend since October 1989 of discounted UF₆ prices due to the oversupply of UF₆ and the relative lack of demand for conversion services.

* * *

Active uranium supply declined to 1.3 million pounds equivalent U₃O₈, over three million pounds less than **active uranium demand** of 4.6 million pounds equivalent U₃O₈. The resultant **supply/demand ratio** is 0.3, marking its second month in a row below 1.0. Nevertheless, though supply sources are not specifically identified, it is highly likely that, just as last month, supply will be made available near current market levels as demand dictates.

Figure 1
NUEXCO UF₆ VALUE LESS
SUM OF UF₆ COMPONENT VALUES¹



¹ UF₆ Value - $[(EV \times 2.61284) + (CV \times 2.20462)]$. If this expression exceeds zero, that represents a UF₆ premium relative to the sum of its components. If the expression is less than zero, it represents a discount.

Long-Term Market Activity

One long-term natural uranium sale is reported this month. A utility purchased over one million pounds of concentrates for delivery in the 1990s. Several utilities are evaluating long-term offers and several more are expected to seek long-term contracts in the upcoming months.

* * *

The **Loan Rate** remained at 3.5 percent per annum for April 30, 1990. Six current loans were concluded in April involving over two and a half million pounds equivalent U₃O₈. One loan that occurred in 1989 is also reported, but not included in the total volume. Specific loan rates varied from contract to contract, but due to the special conditions involved, the loans evaluated at levels near the Loan Rate.

PRICING

Special conditions on loans, such as flexible return dates or origin specifications, may have significant value to borrowers or lenders, and can affect a loan negotiation as much as the loan interest rate. A wide variety of market participants loaned and borrowed material in the past month, indicating further development of the nuclear fuel market as participants seek to utilize inventory to improve their returns on investment.

* * *

The **Conversion Value** was unchanged at **\$1.45** per pound U as UF₆. Market conditions for secondary conversion services are very unpredictable at present. The UF₆ supply glut, though perhaps easing, has led to the wide discrepancy between the UF₆ Value and the sum of the values of its component parts. Although several secondary conversion sales are being negotiated at levels near the April 30 Conversion Value, occasionally discretionary buyers can command extraordinarily low prices from highly motivated sellers due to this inequality in the conversion market. In such instances, holders of UF₆ that need concentrates may be inclined to deeply discount the conversion component in order to deconvert their UF₆. For instance, in the one April conversion sale that occurred well below the April 30 Conversion Value, the buyer was able to obtain a far lower price than otherwise would have been acceptable, because the seller was anxious to acquire concentrates to fill other commitments.

ENRICHMENT SERVICES

The **SWU Value** remained at its previous level of **\$50** per SWU. In a quiet month, no new SWU sales are reported, though several buyers, both North American and European, are evaluating offers. One spot-market SWU buyer examined the opportunities in the current market and decided to borrow enriched UF₆ rather than purchase SWU.

Several utilities evaluated long-term offers in the past month but were dissatisfied with the offers they received, and decided to delay major SWU purchases in expectation of a continuing soft SWU market. SWU supply declined as some sellers decided to withdraw temporarily from the market as well, but SWU demand increased to approximately 1.9 million SWU. The upcoming months should provide some indication of market direction, and alleviate some of the present market uncertainties.

In other enrichment developments, DOE announced another meeting with its USEC customers, to be held in Washington D.C. on June 21-22, 1990. Unexpectedly, DOE did not announce a new base price for fiscal year 1991 on April 1. An April 1 announcement had been expected in order for DOE to meet the 180-day notification requirement and have the new base price take effect at the beginning of FY91. The ceiling price for FY91 will be calculated as June 30, 1990. USEC customers for 1991 pay the lower of the base price or the ceiling price. ■

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

EXCHANGE VALUE¹

Country (currency)	per lb equivalent U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Apr 30, 1990)	Last Month (Mar 31, 1990)	12 Months Ago (Apr 30, 1989)	This Month (Apr 30, 1990)	Last Month (Mar 31, 1990)	12 Months Ago (Apr 30, 1989)
Australia (dollar)	11.69	11.70	12.71	30.40	30.41	33.04
Belgium (comm. franc)	304.50	309.10	396.54	791.63	803.58	1,031
Canada (dollar)	10.24	10.31	12.04	26.62	26.81	31.30
EEC (ecu)	7.24	7.32	9.11	18.82	19.04	23.68
Finland (markka)	34.82	35.29	42.28	90.53	91.74	109.91
France (franc)	49.49	50.25	64.13	128.67	130.63	166.72
Italy (lira)	10,815	11,011	13,877	28,116	28,626	36,078
Japan (yen)	1,402	1,377	1,334	3,645	3,579	3,469
Netherlands (guilder)	16.59	16.82	21.37	43.13	43.72	55.55
So. Africa (comm. rand)	23.39	23.33	25.79	60.80	60.65	67.05
Spain (peseta)	933.29	956.11	1,176	2,426	2,486	3,056
Sweden (krona)	53.56	53.95	64.29	139.25	140.27	167.14
Switzerland (franc)	12.80	13.17	16.74	33.29	34.23	43.52
UK (pound)	5.38	5.38	5.97	13.99	13.99	15.53
US (dollar)	8.80	8.80	10.10	22.88	22.88	26.26
West Germany (mark)	14.77	14.93	18.95	38.39	38.82	49.26

TRANSACTION VALUE¹

Country (currency)	per lb equivalent U3O8 as Concentrates			per kg U as Concentrates		
	This Month (Apr 30, 1990)	Last Month (Mar 31, 1990)	12 Months Ago (Apr 30, 1989)	This Month (Apr 30, 1990)	Last Month (Mar 31, 1990)	12 Months Ago (Apr 30, 1989)
Australia (dollar)	11.50	11.63	13.84	29.88	30.24	35.99
Belgium (comm. franc)	299.31	307.34	431.88	778.13	799.02	1,123
Canada (dollar)	10.06	10.26	13.11	26.16	26.66	34.09
EEC (ecu)	7.11	7.28	9.92	18.50	18.93	25.79
Finland (markka)	34.23	35.09	46.04	88.98	91.22	119.70
France (franc)	48.65	49.96	69.84	126.47	129.89	181.57
Italy (lira)	10,630	10,948	15,114	27,637	28,464	39,293
Japan (yen)	1,378	1,369	1,453	3,583	3,559	3,778
Netherlands (guilder)	16.31	16.72	23.27	42.39	43.47	60.50
So. Africa (comm. rand)	22.99	23.20	28.09	59.76	60.31	73.03
Spain (peseta)	917.38	950.67	1,280	2,385	2,472	3,329
Sweden (krona)	52.65	53.65	70.02	136.87	139.47	182.03
Switzerland (franc)	12.59	13.09	18.23	32.72	34.03	47.40
UK (pound)	5.29	5.35	6.51	13.75	13.91	16.91
US (dollar)	8.65	8.75	11.00	22.49	22.75	28.60
West Germany (mark)	14.52	14.85	20.64	37.74	38.60	53.65

¹ Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

CURRENT MARKET DATA

CONVERSION VALUE¹						
Country (currency)	per lb U as UF ₆			per kg U as UF ₆		
	This Month (Apr 30, 1990)	Last Month (Mar 31, 1990)	12 Months Ago (Apr 30, 1989)	This Month (Apr 30, 1990)	Last Month (Mar 31, 1990)	12 Months Ago (Apr 30, 1989)
Australia (dollar)	1.93	1.93	2.45	4.25	4.25	5.41
Belgium (comm. franc)	50.17	50.93	76.56	110.61	112.28	168.79
Canada (dollar)	1.69	1.70	2.32	3.72	3.75	5.12
EEC (ecu)	1.19	1.21	1.76	2.63	2.66	3.88
Finland (markka)	5.74	5.81	8.16	12.65	12.82	17.99
France (franc)	8.15	8.28	12.38	17.98	18.25	27.30
Italy (lira)	1,782	1,814	2,679	3,929	4,000	5,907
Japan (yen)	231.00	226.85	257.60	509.27	500.11	567.90
Netherlands (guilder)	2.73	2.77	4.13	6.03	6.11	9.09
So. Africa (comm. rand)	3.85	3.84	4.98	8.50	8.47	10.98
Spain (peseta)	153.78	157.54	226.98	339.03	347.32	500.41
Sweden (krona)	8.83	8.89	12.41	19.46	19.60	27.36
Switzerland (franc)	2.11	2.17	3.23	4.65	4.78	7.13
UK (pound)	0.89	.89	1.15	1.95	1.95	2.54
US (dollar)	1.45	1.45	1.95	3.20	3.20	4.30
West Germany (mark)	2.43	2.46	3.66	5.36	5.42	8.07

SWU VALUE AND UF₆ VALUE¹						
Country (currency)	SWU Value at 0.30% Tails Assay			UF ₆ Value per kg U as UF ₆		
	This Month (Apr 30, 1990)	Last Month (Mar 31, 1990)	12 Months Ago (Apr 30, 1989)	This Month (Apr 30, 1990)	Last Month (Mar 31, 1990)	12 Months Ago (Apr 30, 1989)
Australia (dollar)	66.45	66.47	84.31	32.43	32.44	38.37
Belgium (comm. franc)	1,730	1,756	2,631	844.29	857.04	1,197
Canada (dollar)	58.17	58.60	79.87	28.39	28.60	36.35
EEC (ecu)	41.13	41.61	60.43	20.07	20.31	27.50
Finland (markka)	197.85	200.50	280.45	96.55	97.84	127.66
France (franc)	281.20	285.50	425.40	137.23	139.33	193.65
Italy (lira)	61,448	62,563	92,058	29,986	30,531	41,907
Japan (yen)	7,966	7,822	8,851	3,887	3,817	4,029
Netherlands (guilder)	94.25	95.55	141.74	45.99	46.63	64.52
So. Africa (comm. rand)	132.87	132.56	171.09	64.84	64.69	77.88
Spain (peseta)	5,303	5,432	7,799	2,588	2,651	3,550
Sweden (krona)	304.32	306.56	426.48	148.51	149.60	194.14
Switzerland (franc)	72.75	74.81	111.06	35.50	36.51	50.55
UK (pound)	30.57	30.57	39.62	14.92	14.92	18.03
US (dollar)	50.00	50.00	67.00	24.40	24.40	30.50
West Germany (mark)	83.91	84.83	125.70	40.95	41.40	57.22

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

CURRENT MARKET DATA

RECENT TRANSACTIONS

URANIUM SALES¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U₃O₈)	Approximate Price Range² as Percent of Current Exchange Value or UF₆ Value	Buyer	Seller	Remarks
4797	1990	101-300	98-102	Producer	Intermediary	UF ₆
4799	1990	50-100	98-102	Producer	Intermediary	
4802	1990	301-600	98-102	Producer	Intermediary	
4803	1990	301-600	98-102	R ³	Producer	
4804	1990	101-300	98-102	Producer	Intermediary	
4807	1990	301-600	98-102	Utility	Producer	
4809	1990	101-300	98-102	Producer	Intermediary	
4811	1990	601-1,000	93-97	Utility	Intermediary	UF ₆
4815	1990	101-300	103-107	Intermediary	Intermediary	
4816	1990	301-600	98-102	Utility	Intermediary	UF ₆
4817	1990	50-100	98-102	Utility	Intermediary	UF ₆
4818	1990	601-1,000	98-102	Producer	Producer	
4819	1990	301-600	98-102	Producer	Intermediary	UF ₆
4822	1991-2000	1,001-3,000	See Remarks	Utility	R ³	Fixed Price Schedule

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.



CURRENT MARKET DATA

NATURAL URANIUM LOANS¹

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U ₃ O ₈)	Approximate Price Range ² as Percent of Current Loan Rate	Borrower	Lender	Remarks
4801	1990	301-600	98-102	Intermediary	Producer	
4806	1990	301-600	113-117	R ³	Intermediary	
4810	1990	301-600	143-147	Utility	Intermediary	UF ₆
4812	1990	301-600	98-102	Producer	Producer	
4813	1990	101-300	R ³	R ³	Utility	
4814	1989	101-300	143-147	Producer	Utility	1989 Loan
4820	1990	601-1,000	R ³	Intermediary	Utility	UF ₆

CONVERSION SERVICES SPOT MARKET SALES¹

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds U as UF ₆)	Approximate Price Range ² as Percent of Current Conversion Value	Buyer	Seller	Remarks
4800	1990	101-300	48-52	Utility	Intermediary	

ENRICHMENT SERVICES SECONDARY MARKET SALES¹

NUEXCO Transaction Number	Delivery Period	Approximate Quantity ⁴ (thousand SWUs)	Approximate Price Range ² as Percent of Current SWU Value ⁵	Buyer	Seller	Remarks
No transactions for secondary market enrichment services are reported this month.						

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

⁴ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 % tails assay.

⁵ Prices are usually normalized to 0.30% tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

CURRENT MARKET DATA

URANIUM SUPPLY (April 30, 1990)			
Delivery Period¹ (Thousand Pounds of U₃O₈)			
NUEXCO Project Number	Spot or Near-term²	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
89-1201*	1,300	2,000 per year	1990-93
90-1027	—	300 per year	1991-2000
Total	1,300		
INACTIVE			
89-1076	500	250 per year	1990 on
89-1156	200	—	1990
89-1173	750	—	1990
89-1180	1,000	—	1990
89-1209*	300	—	1990
87-1000	—	600 per year	1991-95
87-1123	—	1,000 per year	1990 on
88-1157	—	1,000 per year	1990 on, UF ₆
Total	2,750		
* New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 89-1001, 89-7000A, 90-1000A, 90-1051.			



CURRENT MARKET DATA

URANIUM DEMAND (April 30, 1990)			
Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Inquiries to Purchase: ACTIVE			
89-1183	400	—	1990
90-1026	100	—	1990
90-1038	800	—	1990
90-1064	650	—	1990, UF ₆
90-1077*	1,000	—	1990-91
90-1082*	500	—	1990
90-1085A*	915	—	1990, UF ₆ e
90-1100A*	45	—	1991, UF ₆ e
90-1102*	100	—	1990, UF ₆
90-1103*	100	—	1990
.....			
89-1233	—	160	1991, UF ₆
90-1024	—	250 per year	1992-2001
90-1092A*	—	325	1991-92, UF ₆ e
90-1093A*	—	390	1991-92, UF ₆ e
90-1098*	—	250 per year	1992-94
Total	4,610		
INACTIVE			
89-1067	500	—	1990
89-1175	170	170 per year	1990-91
90-1045A*	405	—	1991, UF ₆ e
90-1099*	265	—	1990
.....			
90-1017*	—	250	1991
Total	1,340		
* New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 89-1229, 89-1254, 89-1256, 89-1260, 90-1001, 90-1008, 90-1034, 90-1046, 90-1060, 90-1067, 90-1069, 90-1074.			

CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND (April 30, 1990)			
NUEXCO Project Number	Delivery Period ¹ (Thousand Pounds of U ₃ O ₈)		Remarks
	Within 1 Year	Beyond 1 Year	
Available for Loan: ACTIVE			
88-1182	4,000	—	U ₃ O ₈ /UF ₆
90-1016	300	—	U ₃ O ₈
90-1033	1,270	—	UF ₆
90-1108*	1,000	—	U ₃ O ₈
90-1096*	600	—	U ₃ O ₈
Total	7,170		
INACTIVE			
90-1031*	500	—	U ₃ O ₈
90-1049*	1,000	—	U ₃ O ₈
Total	1,500		
Inquiries to Borrow:			
No inquiries to borrow are reported			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 90-1036.			

CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND (April 30, 1990)			
Delivery Period¹ (Thousand Pounds of U as UF₆)			
NUEXCO Project Number	Within 3 Years	Beyond 3 Years	Remarks
Available for Sale			
ACTIVE			
89-7002	150	—	
Total	150		
INACTIVE			
<i>None reported</i>			
Inquiries to Purchase			
ACTIVE			
90-1101*	500	—	
90-1072*	550	—	
90-1075*	440		
Total	1,490		
INACTIVE			
<i>None reported</i>			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 89-7000C.			

CURRENT MARKET DATA

SWU SUPPLY AND DEMAND (April 30, 1990)			
Delivery Period ¹ (Thousand SWUs)			
NUEXCO Project Number	Spot or Near-term ²	Intermediate or Long-term	Remarks
Available for Sale			
ACTIVE			
90-1073	145	—	1990
Total	145		
INACTIVE			
88-1082*	100	—	1990
Total	100		
Inquiries to Purchase			
ACTIVE			
90-1071*	150	150 per year	1991-96
90-1079*	1,450	—	1990
90-1080*	90	—	1990
90-1085B*	185	—	1990, UF6e
90-1100B*	15	—	1991, UF6e
.....			
88-1061	—	500	1991-95
89-1262	—	120 per year	1996-99
90-1022A	—	235 per year	1996-99
90-1022B	—	900 per year	2000-13
90-1035	—	300 per year	1996-2000
90-1052	—	280 per year	1996-on
90-1076*	—	350 per year	1992-98
90-1092B*	—	150	1991-92, UF6e
90-1093B*	—	200	1991-92, UF6e
90-1094*	—	1,000	1992-2000
Total	1,890		
INACTIVE			
90-1045B*	95	—	1991, UF6e
.....			
89-1047	—	600	1991-95
Total	95		
[*] New or revised since last month. ¹ Measured from the date of this Report. ² For delivery within one year. This category excludes SWU deliverable within one year under other than spot or near-term contracts. Projects removed since last month: 88-1210, 89-1043, 89-7000B, 90-1000B.			

RECENT DEVELOPMENTS

WASHINGTON FOCUS

Congress continued to work on the budget during April with small breaks to attend Earth Day activities to acknowledge the public's growing environmental conscience. The House Budget Committee once again raised to 100 percent the portion of the Nuclear Regulatory Commission's (NRC) budget to be funded through user fees. However, the Senate Budget Committee authorized continuation of the current 45-percent user fee funding. The full House approved the budget resolution on May 1. The Senate may act sometime in May.

Clean Air Act Amendments

DOE has released new estimates about the impact on enrichment costs of the House version of the Clean Air Act Amendments. The House version is stricter on emission standards, and requires pollution control equipment installation by 1995 instead of 2000, which is the Senate version's deadline. DOE estimates the House amendments will increase the cost of enrichment by \$20-\$24 per SWU between 1995 and 2000, requiring increased spending in the enrichment program of an additional \$600 million over that period.

Uranium Enrichment Reorganization Act

The House Science, Space & Technology Committee staff recently released a draft substitute of HR 2480 (The Uranium Enrichment Reorganization Act). The original bill was introduced last year by Reps. Marilyn Lloyd (D-TN), Bob McEwen (R-OH), and Carroll Hubbard (D-KY) for the Bush Administration. Several hearings were held by the committee last year, but the other two House committees with jurisdiction—Energy & Commerce and Interior & Insular Affairs—have not yet considered the bill. The draft will be the subject of new hearings shortly.

While much of the intent of the Administration's bill remains in the draft, several significant changes have been made by the committee. The corporation created by the bill would remain a wholly-owned government corporation until Congress passes a new law permitting privatization. This corporation would be allowed to enter into joint-venture or equity-participation agreements with private sector companies. In the Senate's version of the bill, the corporation would be required to submit a privatization report to the President for his authorization, while the House's version would permit the corporation to avoid the annual appropriations process, and would allow leases and contracts to be transferred to the corporation. However, these leases and contracts would have to be renegotiated within five years. The corporation would have a five-member managing board of directors, appointed by the President for five-year terms.

At the time of enactment, those DOE personnel employed in what will be the corporation's activities could either transfer to other government positions or could accept employment by the corporation, but then would no longer be employees of the government. All property would be also be transferred to the corporation, including the shutdown gaseous-diffusion plant (GDP) at Oak Ridge, Tennessee. Additionally, the corporation would be able to issue up to \$2.5 billion in bonds (not backed by the US government) in order to build new technology (AVLIS), and royalties would be paid on patents obtained from the US government.

The House's version of the bill would allow the corporation maximum management flexibility, including provisions permitting business practices to

RECENT DEVELOPMENTS**DOE Enrichment
Program and AVLIS**

remain proprietary. Under negotiation a requirement for the US utility customers to pay for the decommissioning and decontamination (D&D) of all the GDPs by an added 0.25 mil/KWh fee assessed through the Nuclear Waste Fund. Fifty percent of the total D&D costs for facilities (the Defense Department contribution) would be paid from yearly appropriations and non-US customers would also contribute through the price they pay for SWU. Within two years of enactment, the corporation would be required to prepare a D&D plan for the Oak Ridge GDP, for submission for Congressional review.

The Senate Energy & Natural Resources subcommittee on Energy R&D held a hearing on DOE's uranium enrichment program and AVLIS on May 1. Witnesses included William Young, DOE Assistant Secretary for Nuclear Energy; Robert Calabro, Manager, Nuclear Fuels at the Tennessee Valley Authority (TVA); and Gerald Grandey, president of the Uranium Producers of America (UPA).

Senator Wendell Ford (D-KY) from the subcommittee is concerned that DOE has not made enough progress in becoming more competitive or in encouraging the House of Representatives to consider restructuring legislation. He reported that DOE has asked Congress to reprogram \$16 million from the FY90 uranium enrichment budget to plutonium production at Savannah River, and for design certification of the advanced light water and liquid metal reactor programs. Sen. Ford is unhappy with this request and has indicated that if DOE continues seeking acceptance of it, he will try to kill its approval. Further, if the enrichment program had a surplus, he said it should be spent on making the enrichment program more competitive, set aside as working capital for the government corporation, or spent on accelerating compliance with environmental regulations. Sen. Ford expressed his fear that AVLIS will become the GCEP (Gas Centrifuge Enrichment Program) of the 1990s. Mr. Young responded he has much greater confidence in AVLIS because the program only needs another \$500 million to reach the demonstration stage and it will be demonstrated at almost commercial scale.

The testimonies of Mr. Calabro and Mr. Grandey focused on the commercial market. TVA was asked to testify because it recently requested long-term (post-1996) bids for enrichment services and Sen. Ford was unhappy that TVA was not contracting only with the DOE. Mr. Calabro explained that TVA has an obligation to be as competitive and low cost for their rate payers as a private utility. TVA is currently 100-percent committed to DOE for enrichment services through 1995, and has committed 70 percent of its requirements to DOE through 2000. Although TVA asked for bids on the open 30%, it had not signed any long-term contracts and was still considering its options. In his oral testimony, Mr. Grandey asked Congress to consider requiring US utilities to consider other factors in their procurement decisions other than just pricing, such as security of supply. ■

INDUSTRY BRIEFS

Comanche Peak 1 Receives Operating License

The NRC unanimously approved a full-power operating license for Texas Utilities Electric Company's (TUEC) controversial Comanche Peak 1 on April 16, twelve years after an operating license application was submitted. Concerns over quality assurance caused the delay, but in 1988 TUEC reached an unprecedented settlement with its last opponent, the Citizens Association for Sound Energy (CASE). The president of CASE or their designee, serves for at least five years on the unit's Operating Review Committee. Comanche Peak 1 is expected to reach full power during this summer.

♦ ♦ ♦

Crow Butte Project Receives Permit To Mine

The Nebraska Department of Environmental Control has issued a permit to Ferret Exploration Company to proceed with in-situ leach mining at the 2500-acre Crow Butte site near Crawford, Nebraska. Construction of the plant and wellfield is set to begin immediately, with production scheduled for 1991. Ferret first applied for the permit in November 1987.

Japan's Socialist Party Supports Nuclear Energy

In an abrupt policy reversal, Japan's Socialist party (JSP) publicly announced it supports nuclear power—pending the development of an acceptable alternative. The JSP, the government's largest opposition group, recommended that the government:

- allow existing nuclear power plants to operate, but permit no new nuclear plant construction,
- accelerate R&D efforts for alternative energy sources,
- gradually phase out existing nuclear power plants and replace them, when possible, with an improved energy mix.

♦ ♦ ♦

Nuclear Power Generated 17% of Electricity in 1989

According to the most recent IAEA estimates, nuclear power generated 17 percent of the world's total electricity in 1989, or approximately 1.85×10^{12} KWh. Nuclear power accounted for more than 50 percent of total electricity generation in Belgium, France, Hungary, South Korea, and Sweden.

South Africa 1st Quarter Production

Although most of South Africa's gold mines reported profit increases due to improved rand prices for gold and more efficient mining, uranium production for the first quarter of 1990 (1,723,000 pounds equivalent U₃O₈) declined a further 7.5%, compared to the fourth quarter of 1989 (1,863,000 pounds). Only Buffelsfontein showed an increase, though it was less than 2% (190,000 vs. 187,000 pounds). The other five mines showed losses in output, particularly Ergo which was down 39% (53,000 vs. 87,000 pounds). Western Areas declined 12% to 120,000 pounds, Freegold dropped 10% to 213,000 pounds, Vaal Reefs slowed by 7% to 948,000 pounds, and Hartebeestfontein was down slightly to 194,000 pounds.

RECENT DEVELOPMENTS

Malapai Sale Agreement Reached

Société Auxiliaire d'Énergie (SAE), a subsidiary of Electricité de France (EdF), has reached an agreement in principle to acquire Malapai Resources Co. from the financially-troubled Pinnacle West Capital Corp. Total Minerals Corp., the US subsidiary of Total Mines Nucleaires (France) will operate the acquisition on behalf of the new owners. Malapai's uranium properties include Christensen Ranch and Irigary in Wyoming, and El Mesquite in Texas, which have combined uranium resources of 45 to 50 million pounds equivalent U₃O₈. Malapai holds a number of long-term supply contracts, one of which is with EdF which is committed to purchase 250 thousands pounds annually.

Swedish Nuclear Phase-Out Delay More Likely

In a further concession that Sweden's ambitious nuclear power phase-out program cannot occur without compromising environmental goals, Swedish Prime Minister Carlsson recommended the relaxation of restrictions on carbon dioxide emissions. Appealing to the non-Socialist parties, Carlsson said that unless they allow some increases in carbon dioxide emissions, the nuclear phase-out could not begin in 1995 as they specified. The recommendation came from the four-member Social Democratic committee, formed in 1989 to develop a compromise energy policy. The government is under pressure to issue an energy bill by the end of the year for Parliamentary vote in early 1991.

VEW Signs Reprocessing Contract With BNFL

Vereinigte Elektrizitätswerke Westfalen AG (VEW) became the first West German utility to sign a long-term reprocessing contract with British Nuclear Fuels plc. following the 1989 cancellation of West Germany's Wackersdorf reprocessing plant. Under the contract, reprocessing of 450 metric tons from the Emsland PWR will be performed at BNFL's Thorp, England plant, beginning in 2004. In 1989, the West German government gave approval for foreign reprocessing, after which the West German utilities entered into reprocessing discussions with BNFL and Cogema. No agreements have been reached yet with Cogema, for reprocessing at its La Hague, France plant.

CORRECTION

On page 20 of the previous Monthly Report (April 1990, No. 260) we incorrectly reported; "Uranerz Buys One-Third of Cogema's Rabbit Lake Operations." The headline should have read "Uranerz Buys One-Third of Cameco's Rabbit Lake Operations." The text of the article correctly stated Cameco as the seller.

THE ECONOMIC FUTURE OF THE US URANIUM INDUSTRY

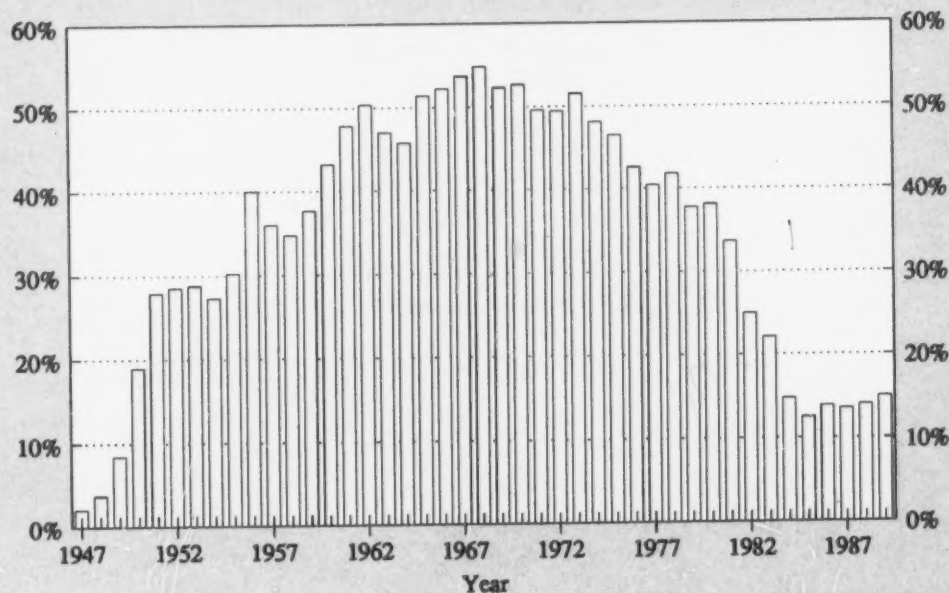
The following is a speech presented by Thomas C. Pool of NUEXCO to a Uranium Workshop sponsored by the US Geological Survey, in Denver, Colorado on March 20, 1990.

In the past decade, the US uranium industry has been reduced from the position of world leader to that of an ordinary supplier. This reduction can be measured in a number of ways: reduced production; reduced exploration activity; and reduced employment. Are there prospects for any increases in the US uranium industry? If so, what, when, and to what degree? This paper addresses some of those questions.

Historical Role

In the 1960s US producers accounted for 50% of the commercial uranium market which, at the time, excluded China and the Soviet bloc nations (Figure 1). In the 1970s the US uranium industry spent up to \$300 million per year on exploration. In 1979 the industry employed almost 22,000 people. By any of these measures, the US uranium industry is just a shadow of what it once was. So are uranium spot prices as indicated by the NUEXCO Exchange Value. It has dropped from a high of \$43.40 per pound U_3O_8 in 1978 to a current value of \$8.70 per pound (as of February 28, 1990). The difference is even more pronounced in constant dollars: \$72.84 versus \$8.70, almost a full order of magnitude.

Figure 1
US SHARE OF
COMMERCIAL URANIUM PRODUCTION



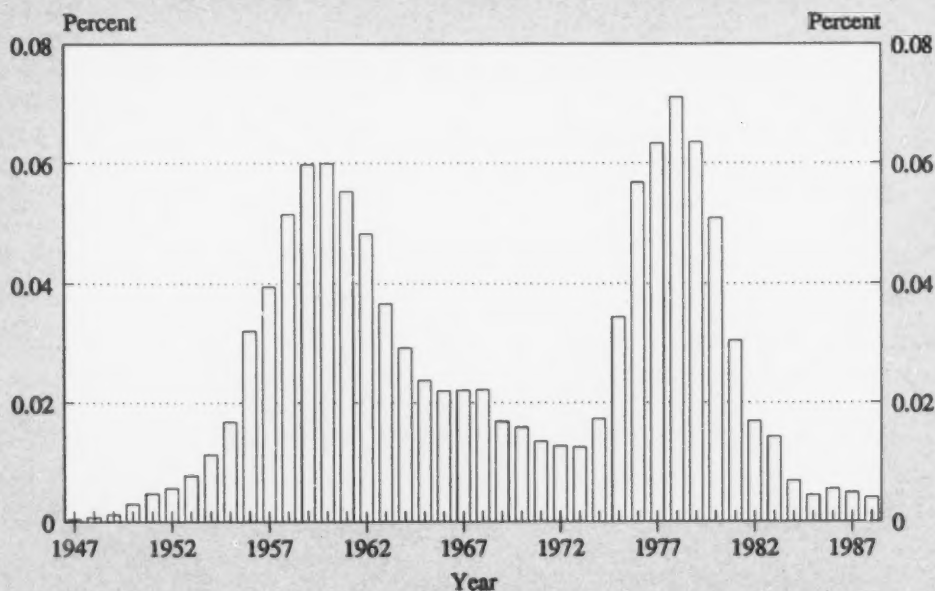
ANALYSIS AND COMMENTARY

With the drop in both price and production, the US uranium industry has lost any clout it might have had with Washington. In 1978, uranium production in the USA could be valued at 0.07 percent of the US GNP—a significant contribution. Today, however, that share has dropped to about 0.003 percent (**Figure 2**). By contrast, the US coal industry's contribution to the GNP is about one half of one percent, or some 160 times greater than that of the uranium industry.

Let's examine some of the measures of US uranium industry activity on a historical basis (**Figures 3, 4, and 5**).

These measures include production, employment, and exploration expenditures. The graphs illustrate a clear correlation of these measures with price. Thus, as market prices increase or decrease, activity in the US uranium industry follows accordingly. The picture is not necessarily the same for some other countries where either production costs are so low as to be unaffected by current price levels, or where most production is committed under long-term contracts at prices in excess of current levels. US uranium producers are generally not blessed with either very low costs or long-term contracts.

Figure 2
VALUE OF US URANIUM PRODUCTION¹
AS A PERCENTAGE OF US GROSS NATIONAL PRODUCT



¹ Value of production based on production volume times average price for the year. Average price for 1947-1968 based upon average Atomic Energy Commission (AEC) price paid in ore buying program; average price for 1969-present based upon NUEXCO Exchange Value.

ANALYSIS AND COMMENTARY

Figure 3
US URANIUM PRODUCTION VS. SPOT PRICE OF URANIUM¹

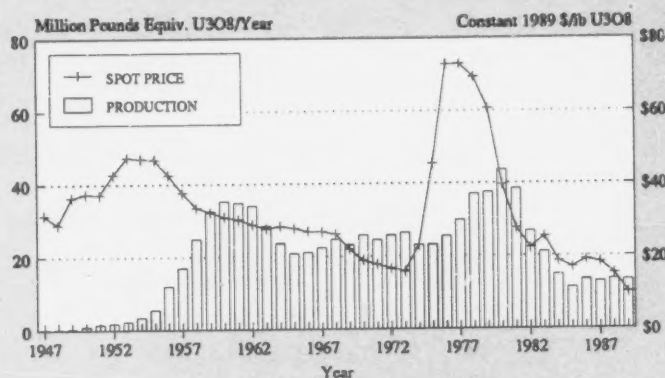


Figure 4
US URANIUM EXPLORATION EXPENDITURES VS. SPOT PRICE OF URANIUM¹

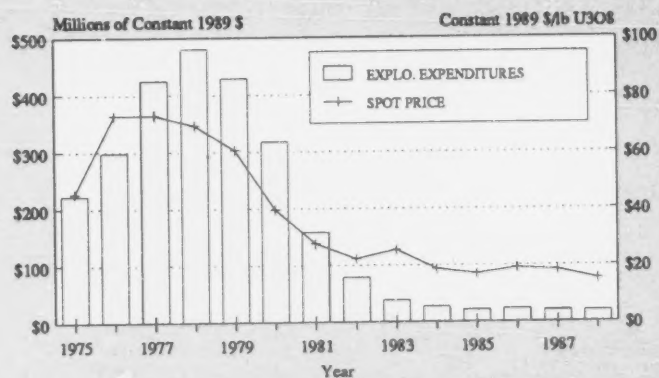
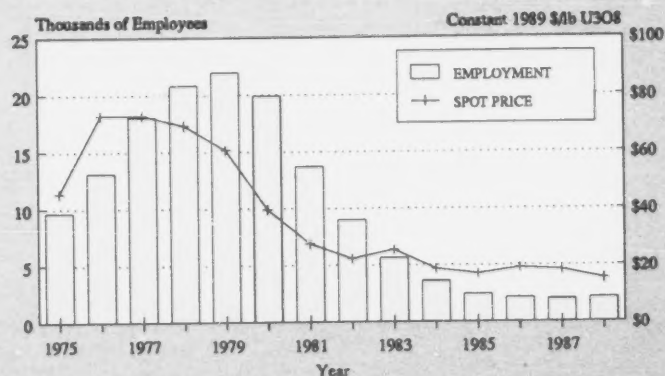


Figure 5
US URANIUM INDUSTRY EMPLOYMENT VS. SPOT PRICE OF URANIUM¹



¹ Price for 1947-1968 based upon average Atomic Energy Commission (AEC) price paid in ore buying program; average price for 1969-present based upon NUEXCO Exchange Value.

ANALYSIS AND COMMENTARY

NUEXCO has examined most US uranium deposits in terms of both available resources and forward marginal costs¹ of production (defined in footnote to Figure 6). This information has been compiled into a cost versus resource curve (Figure 6). This curve provides the basis for projecting the future of the US uranium industry.

On a very rough historical basis, annual production from an economic reserve base approximates five percent of that

reserve base. Applying this factor to the cost/resource curve, we can project with some confidence that, if prices increased to about \$20 per pound, US uranium production could well reach 20 million pounds per year (Figure 7). Therefore, it remains only to forecast spot prices and apply that information to the cost/resource curve.

NUEXCO prepares a semi-annual analysis of uranium supply and demand from which future uranium prices are

Figure 6
US URANIUM RESOURCES
COST¹ VS. QUANTITY

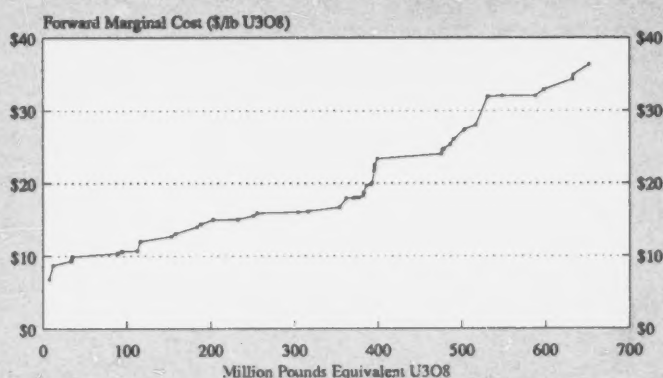
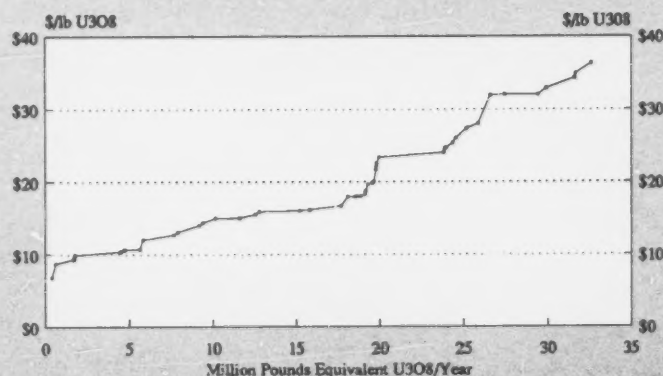


Figure 7
US URANIUM PRODUCTION CAPABILITY
VS. SPOT PRICE² OF URANIUM



¹ Forward marginal costs are the future costs required to achieve or maintain the desired rate of production. For operating properties, the forward marginal cost is taken as the operating cost, including labor and supplies. For undeveloped properties the forward marginal cost also includes depreciation of the estimated capital cost of development.

² The spot price represents NUEXCO's forecast of the average price (in constant 1989 US dollars per pound U₃O₈) at which transactions would occur in the year indicated, for which delivery is made within one year of contract signing.

ANALYSIS AND COMMENTARY

projected (Figure 8). The October 1989 forecast projects prices to rise moderately through the year 2005.

By factoring the NUEXCO price forecast into the US uranium production capability curve, we can produce a view of future US uranium production (Figure 9). From this analysis, US uranium production is expected to show further decreases through 1994, but to rise to modest levels of about 15 million pounds U₃O₈ per year by 1997.

Increased production will be accompanied by increased employment—back to almost 5,000 by the year 2005 (Figure 10). Increasing prices will also generate renewed enthusiasm for exploration, and those expenditures could increase from current levels of about \$20 million per year to \$50 million per year by 1995 (Figure 11).

Figure 8
ESTIMATED RANGE AROUND THE
NUEXCO URANIUM SPOT PRICE¹ FORECAST²

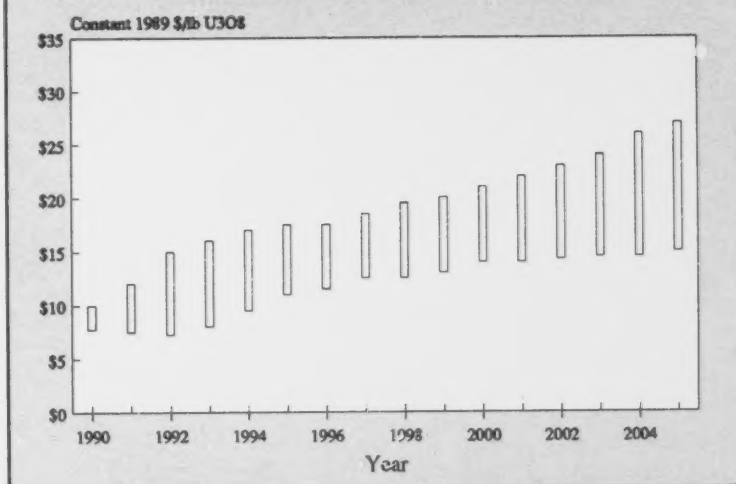
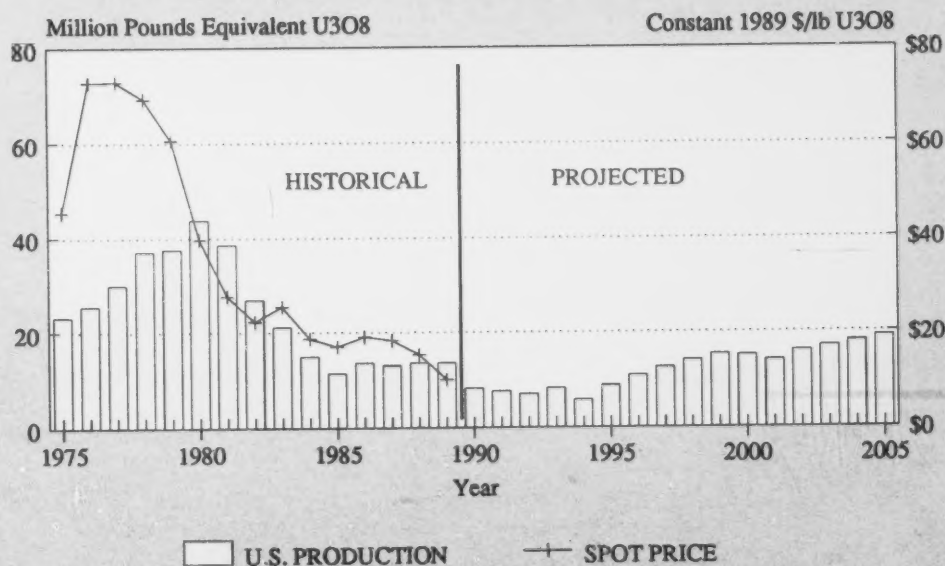


Figure 9
US URANIUM INDUSTRY PRICE³— PRODUCTION RELATIONSHIP



¹ The spot price represents NUEXCO's forecast of the average price (in constant 1989 US dollars per pound U₃O₈) at which transactions would occur in the year indicated, for which delivery is made within one year of contract signing.

² Forecast of spot price ranges as of October 1989. An updated, detailed spot price forecast is currently available from NUEXCO Information Services.

³ Price levels shown are the annual average of the NUEXCO Exchange Value for the year indicated.

ANALYSIS AND COMMENTARY

Conclusion

The US uranium industry is unlikely ever to regain the level of production and success that it enjoyed in the late 1970s. However, as I have demonstrated here, there is a stable, profitable future, albeit limited, for the industry when uranium spot prices rise.

As the price of uranium increases, production levels will follow, as will employment levels and exploration activity. The US uranium industry must continue to endure this shift of the world market, and prepare to take advantage of the situation when the market eventually turns upward. ■

Figure 10
US URANIUM INDUSTRY
PRICE¹-EMPLOYMENT RELATIONSHIP

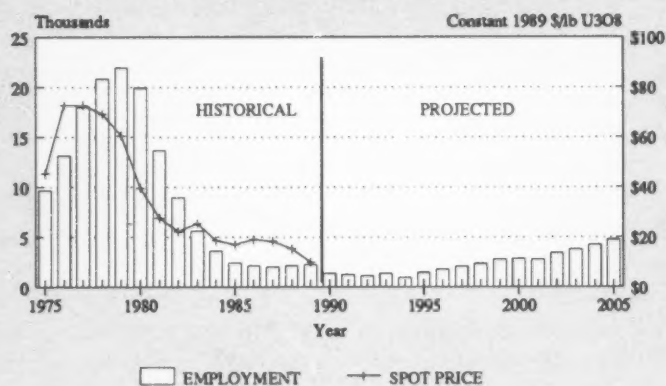
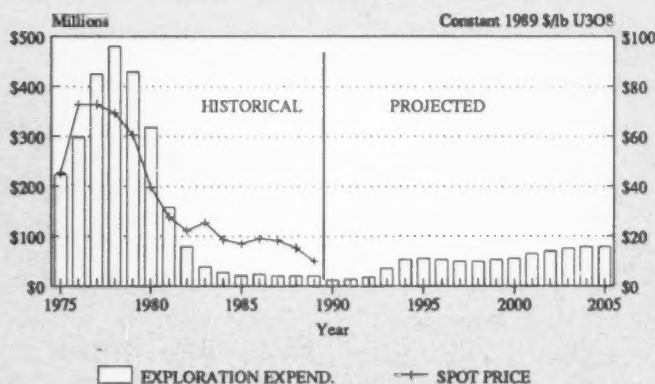


Figure 11
US URANIUM INDUSTRY
PRICE¹-EXPLORATION RELATIONSHIP



¹ Price levels shown are the annual average of the NUEXCO Exchange Value for the year indicated.

INTERNATIONAL ATOMIC ENERGY AGENCY

The International Atomic Energy Agency (IAEA) is best known for its nuclear material safeguarding system to ensure non-proliferation of nuclear weapons. Although it is the IAEA's most important responsibility, safeguarding of nuclear material and facilities is just one area in which the agency is involved. It also provides research and technical assistance to members, and is active in nuclear power research, safety, and fuel cycle development.

Background

The IAEA is an intergovernmental agency headquartered in Vienna, Austria. In 1953, US President Dwight D. Eisenhower proposed the idea for an international agency to promote the peaceful use of atomic energy in his "Atoms for Peace" plan. After several years of negotiations, the United Nations (UN) General Assembly officially established the IAEA on July 29, 1957.

The objective of the IAEA is expressly stated in Article II of its statute. "The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose."

The IAEA General Conference is made up of 113 Member States. It is led by a Board of Governors comprised of delegates from 35 member countries, and an elected Secretariat. The Secretariat consists of a Director-General and five Deputy Directors-General. The Board of Governors meets several times per year, and the General Conference assembles once a year, usually in September. Dr. Hans Blix, former foreign minister of Sweden, was re-elected at last September's conference to his third four-year term as Director-General. The IAEA employs over 2,000 people of nearly 80 nationalities and has an annual budget of well over US\$ 200 million.

Role of the IAEA

The IAEA is an autonomous agency with its own statutes. Although it was created through the UN and is expected to operate in accordance with UN purposes and principles, the

IAEA is not a specialized agency of the UN and acts independently. The IAEA participates in a number of cooperative ventures with other international and regional agencies. For instance, it works with the World Health Organization, the UN Environment Program, the Nuclear Energy Agency of the Organization for Economic Cooperation and Development (NEA/OECD), and several other agencies on projects assessing nuclear safety and radiation protection.

The agency plays a vital role in international affairs. Its research efforts toward improved reactor technology and better safety, as well as the scientific, agricultural and resource support it provides to developing nations, are very important for advancing nuclear power and world stability. However, the IAEA has its greatest effect on foreign affairs through its nuclear safeguarding program.

Established in the 1960's, the IAEA's safeguards system is the most important factor in the effort to prevent the proliferation of nuclear weapons. The system is the first successful example of inspection of national facilities by an international body. With the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the Treaty for the Prohibition of Nuclear Weapons in Latin America (Tlatelolco Treaty), the South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty), and other individual agreements, nearly 150 states have safeguards agreements in place, covering approximately 95% of civilian nuclear facilities worldwide.

The NPT is the most widely followed agreement; 138 Non-Nuclear Weapons States subscribe to its safeguards. All five Nuclear Weapons States, as defined by the NPT (USA, USSR, UK, France, and China), have safeguards agreements in place as well. (The USA, USSR, and the UK were early signatories to the NPT. France and China have not signed the NPT, but have reached accord on safeguarding terms.) Recent signatories to the NPT include Kuwait and Qatar in 1989, and Saudi Arabia and Bahrain in 1988. Some of the key countries that have nuclear power capabilities but have not signed the NPT include Argentina, Brazil, Israel, and South Africa. A future goal is to develop a single set of comprehensive safeguards standards for the entire world.

The future of the NPT will reach a critical point in 1995. Although the treaty will not expire, a vote by NPT signatories will be required to determine whether to extend the treaty indefinitely or only for a certain period of time agreed to by a majority of the signatories. Although the vote is still five years away, some countries have already begun their efforts to influence the outcome.

For example, the USA would like to see the treaty extended indefinitely because of its effectiveness in controlling the spread of nuclear weapons. In contrast, Argentina, which has not signed the NPT, is lobbying to have the NPT dissolved and a new treaty negotiated. It regards the treaty as discriminatory, because it has separate guidelines for Nuclear Weapon States and all other signatories.

Major Activities

The IAEA is regularly involved in three major areas — research and technical assistance; nuclear power, safety, and fuel cycle development; and safeguarding nuclear material and facilities.

Research and Technical Assistance

The IAEA provides development assistance to member countries in numerous fields that can benefit from the use of nuclear science. This is the most diverse area of IAEA involvement. Programs range from food preservation through irradiation, plant breeding and genetics, and soil preservation, to insect and pest control, animal production and health, and energy planning and policy development. The IAEA also provides laboratories to facilitate the exchange of research and information.

For instance, at the International Center for Theoretical Physics in Trieste, Italy, scientists and experts from developing countries conduct research and promote the importance of nuclear energy worldwide. Programs sponsored by the IAEA in these many different areas are very important to lesser developed nations, and the IAEA plays a vital role in providing the resources to assist the technological development of these countries.

Nuclear Power, Safety, and Fuel Cycle Development

The IAEA's primary emphasis in this area is to promote safety in the development of nuclear energy. It supplies

funding and information resources to improve nuclear plant performance and develop new reactor technologies by arranging conferences, seminars, and joint research ventures. It offers safety inspection teams and expert groups to assist countries requesting advice on how to improve their nuclear facilities. In addition, the IAEA provides technical assistance and consulting in energy planning, safety, radiation protection, and assists in the development of safe waste management techniques.

Safeguarding Nuclear Material and Facilities

One of the major responsibilities of the IAEA is the safeguarding of all civilian nuclear material and facilities. The NPT does not cover military programs, so the IAEA's safeguarding system only applies to civilian nuclear programs. The agency works to improve current safeguard standards, and to support the NPT and other international safeguards agreements. All signatories to the NPT and other similar agreements must allow inspections by the IAEA. Through these inspections, the agency ensures the peaceful use of nuclear material. At the end of each year, the IAEA reports whether all material under its safeguards remained in peaceful nuclear activity or was otherwise accounted for appropriately.

Organizational Structure

The IAEA is organized into five main departments beneath the Secretariat, each headed by a Deputy Director-General.

Department of Administration manages the operations at the IAEA. It is responsible for budgets, finance, external relations, and public information. This department also handles any language needs by members, legal and personnel matters, and general services.

Department of Nuclear Energy and Safety monitors the safety of nuclear fuel cycle facilities. OSART (Operational Safety Review Team) inspects nuclear facilities by invitation to help improve their operational safety. OSART inspections are made by request, and focus on the operational aspects of the facility. The nearly 30 inspections so far have significantly improved the facilities visited, but the future of this review process depends on the cooperation and participation of all members, especially

FOCUS

those countries with large nuclear programs. The Department of Nuclear Energy and Safety also maintains a computerized database known as the Incident Reporting System (IRS) to compile and analyze all information on any safety incident occurring worldwide.

Department of Research and Isotopes deals primarily with non-nuclear power areas. It allocates the resources of the Technical Assistance and Cooperation Fund to areas such as life sciences, food and agricultural development, the International Center for Theoretical Physics, and the Agency's laboratories.

Department of Safeguards has the most significant impact on the success of the IAEA because it fulfills the Agency's primary objective: the non-proliferation of nuclear weapons. Funded from the regular budget, monies are distributed to this department for actual safeguards operations and inspections, the development and technical support of safeguards, the treatment of safeguards information and evaluation, and training and administrative support.

Department of Technical Cooperation prepares and distributes IAEA publications and oversees the many diverse programs of technical assistance and cooperation.

Regulatory Authority

The safeguards system is the IAEA's primary means of regulation in support of its major objective of non-proliferation. The IAEA requires all countries adhering to safeguards agreements to maintain detailed records of all material and facilities related to civilian nuclear energy, and to ensure their non-military use. All States must satisfy the IAEA that they have complied with all terms of their safeguards agreements, by allowing the IAEA to periodically inspect their records and verify the use of safeguarded material. These inspections are required of all countries that have safeguards agreements in place. The IAEA designates inspectors after consultation with the nation involved, so only mutually acceptable inspectors are selected. These verifications constitute regulatory inspections of material and facilities, not operational reviews like OSART visits.

If a state cannot satisfy the IAEA that all safeguarded material has been used for peaceful purposes, the IAEA will call upon the state to correct the situation immediately, and will report the non-compliance to all IAEA members and to the Security Council and General Assembly of the UN. If the problem is not resolved within a reasonable length of time, the IAEA Board of Governors may suspend or curtail any assistance provided to the non-complying state by the IAEA or any of its members. Additionally, the General Conference of the IAEA may, if recommended by the Board of Governors, suspend the membership of the non-complying state by a two-thirds majority vote.

For example, at the 1989 General Conference last September, South Africa, for the second consecutive year, narrowly avoided suspension for non-compliance violations; the vote was delayed until the next conference in September 1990. Also, Israel has been called upon to comply with a UN resolution to submit all of its nuclear activities to safeguards. Non-Signatories to the NPT or other agreements are not regulated by the IAEA, but international pressure can be exerted through the influence of the UN and by the fact that the NPT prohibits the exchange of nuclear information or material to non-signatory countries unless that material is subject to IAEA safeguards.

Resources

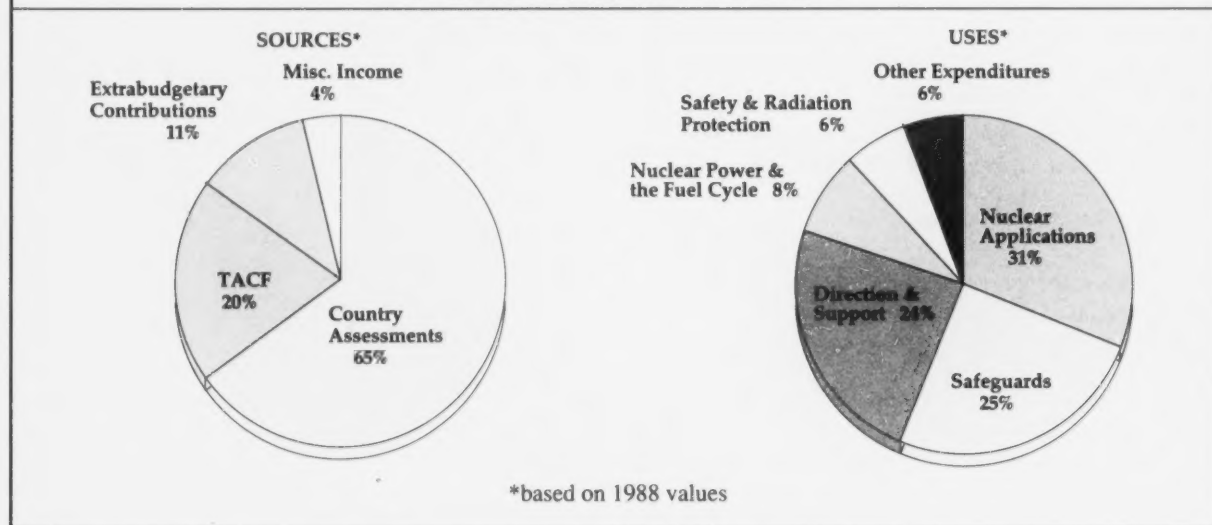
Although the budget of the IAEA has increased significantly since its inception, it is still modest in relation to other comparable international agencies. The budget comprises two major areas—the regular budget and the

Table 1
IAEA 1990 TOTAL BUDGET

US\$ 158.3 million	Regular Budget
US\$ 45.5 million	Technical Assistance & Cooperation Fund (TACF)
US\$ 25.2 million	Estimated Total Extrabudgetary Contributions ¹
US\$ 229.0 million	Total Funds

¹ based on 1988 percentages

Figure 1
IAEA BUDGET SOURCES AND USES



operational budget. The regular budget is funded by contributions from Member States according to an annual assessment, with miscellaneous income accounting for the small remaining balance. The formula for assessment treats all countries equally, but has special provisions to limit the costs to developing nations: The regular budget is used for ordinary administrative expenses, special panels, experts, conferences, information services, and safeguards expenses. The 1990 regular budget is US\$158.3 million, and the Technical Assistance and Cooperation Fund (TACF) budget is US\$45.5 million (Table 1). Both of these budgets have had zero real growth since 1983.

The operational budget is financed by voluntary contributions from member States and is placed in the TACF. Typically, the donor designates the money to particular programs in areas such as technical assistance, research, or training. In addition to these two major areas of funding, some extrabudgetary contributions are usually made each year to certain programs falling under both the regular and operational budgets. **Figure 1** shows a breakdown of budget sources and uses.

Publications

IAEA's reputation as an authority in nuclear energy is based in part upon its extensive information resources. By the end of 1988, the agency's main database contained over 1.2 million records covering about 90 percent of the world's published nuclear literature. It regularly publishes technical and reference material, as well as documents for public information. Among the journals distributed to the public are the *IAEA Newsbrief* (ten times per year), the quarterly *IAEA Bulletin*, the *IAEA Yearbook*, as well as specific journals regarding topics such as fusion and nuclear safety developments. *Uranium: Resources, Production and Demand* (commonly referred to as the "Red Book"), is jointly published by the IAEA and the NEA/OECD. It is a widely read reference familiar to many nuclear industry participants. The IAEA also publishes reference material covering nuclear power reactors and research reactors, energy and power forecasts, and fuel cycle trends. A journal listing abstracts of the information contained in its main database is also available.

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Conferences and Seminars

The IAEA also sponsors conferences and seminars to further international communication and cooperation in atomic energy. Some upcoming events include:

Conferences

- *International Symposium on Nuclear Techniques in Exploration and Exploitation of Energy and Mineral Resources*
Vienna, Austria June 5-8, 1990
- *International Symposium on Balancing Automation and Human Action in Nuclear Power Plants*
Munich, West Germany July 9-13, 1990
- *International Conference on Plasma Physics and Controlled Nuclear Fusion Research*
Washington, D.C., USA October 1-6, 1990
- *International Symposium on High-Dose Dosimetry for Radiation Processing*
Vienna, Austria November 5-9, 1990

Seminars

- *IAEA/NEA International Seminar on the Use of Unusual Event Reports for Improving Nuclear Power Plant Safety*
Vienna, Austria May 14-18, 1990
- *International Seminar on the Costs and Financing of Nuclear Power in Developing Countries*
Jakarta, Indonesia September 4-7, 1990
- *Seminar on Spent Fuel Storage—Safety, Engineering and Environmental Aspects*
Vienna, Austria October 8-12, 1990
- *Regional Seminar for Europe and the Middle East on Quality Management for Nuclear Power Projects*
Prague, Czechoslovakia November 12-16, 1990

Conclusion

The IAEA is the preeminent agency for advancing the peaceful uses of atomic energy and is viewed favorably by most countries. As international political relations improve, and as more countries adopt safeguard measures, the IAEA hopes to enlarge its role in improving the international nuclear industry. The IAEA is dedicated to providing information and resources to further the role of nuclear power as an energy source, and is poised to advance the uses of atomic energy in the 1990's. ■

Nuclear Industry Calendar

1990

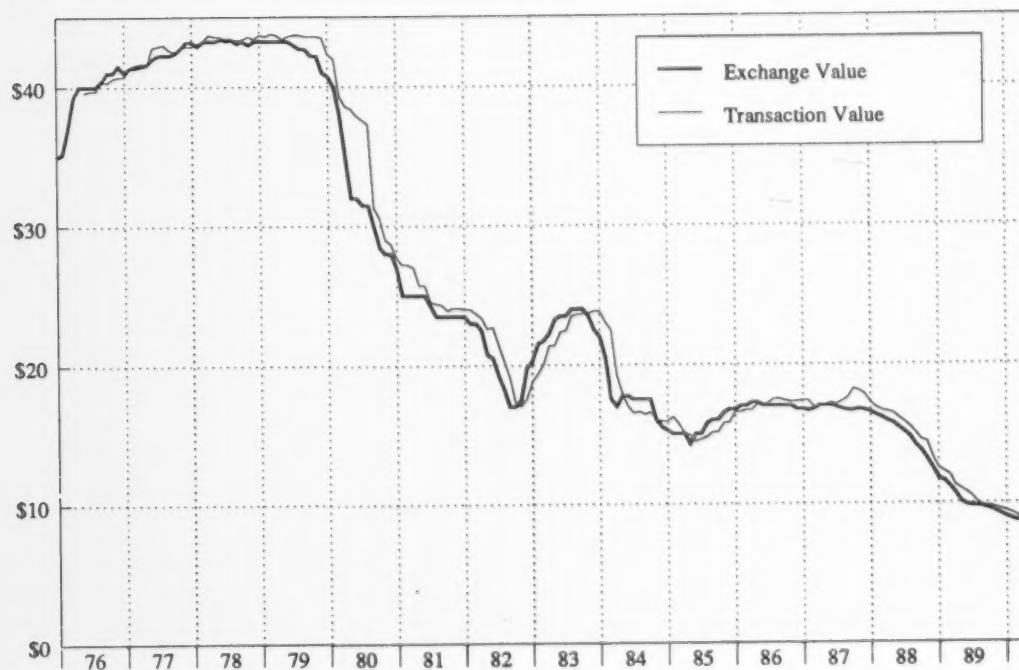
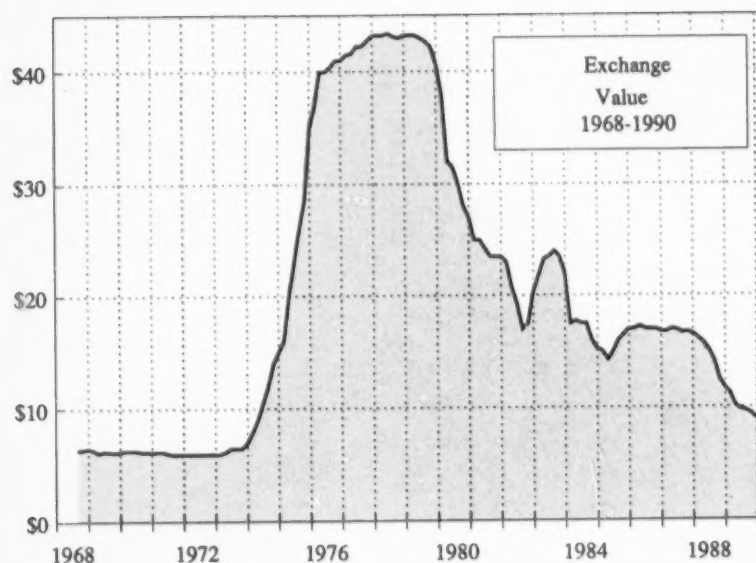
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| May 21-23 | 1990 Nuclear Power Assembly (Washington, DC). Contact American Nuclear Energy Council at 1-202-484-2670. |
| June 3-7 | 30th Annual Conference of the Canadian Nuclear Association and 11th Annual Conference of the Candian Nuclear Society (Toronto, Canada). Contact Canadian Nuclear Association, 111 Elizabeth Street, Toronto, Ontario, Canada M5G 1P7. |
| June 5-8 | International Symposium on Nuclear Techniques in Exploration and Exploitation of Energy and Mineral Resources (Moscow, USSR). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria. |
| June 10-15 | American Nuclear Society Annual Meeting (Nashville, Tennessee). Contact American Nuclear Society at 1-708-352-6611. |
| Sept. 4-7 | International Seminar on the Costs and Financing of Nuclear Power in Developing Countries (Jakarta, Indonesia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria. |
| Sept. 5-7 | Uranium Institute 15th Annual Symposium (London, England). Contact the UI at 44-1-225-0308. |
| Sept. 16-19 | Uranium Seminar '90 (Hyatt Regency, San Antonio, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770. |
| Sept. 23-28 | ENC '90 Congress & Exhibition (Lyon, France) organized by the European Nuclear Society in collaboration with the ANS and Foratom. Contact Dr. P. Feuz, European Nuclear Society at 31-21 61 11. |
| Oct. 14-16 | World Nuclear Fuel Market Annual Meeting (Toulouse, France). Contact Donna Cason at 1-404-447-1144. |
| Nov. 11-14 | Nuclear Energy Forum (Washington Hilton, Washington, D.C.), sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611. |

1991

- | | |
|--------------------|--|
| April 14-18 | Third International Conference on Nuclear Fuel Reprocessing & Waste Management (Sendai, Japan), sponsored by the Atomic Energy Society of Japan and the Japan Atomic Industrial Forum, co-sponsored by the American Nuclear Society and the European Nuclear Society. Contact the Japan Atomic Industrial Forum at telephone 3-508-2411, or facsimile 3-508-2094. |
| May | Second International Conference on Transportation for the Nuclear Industry (Bournemouth, England). Contact The Conference Secretary, The Institution of Nuclear Engineers, at 01-698 1500. After May 6, 1990, the number will be 081-698 1500. |

HISTORICAL MARKET DATA

**NUEXCO Historical
Exchange and
Transaction Values**
(In US Dollars/Pound U₃O₈)



HISTORICAL MARKET DATA

HISTORICAL MARKET VALUES

EXCHANGE VALUES												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85	8.70	8.80	8.80								

US PREMIUM (Relative to the Exchange Value)												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	Discontinued	

HISTORICAL MARKET DATA

UF6 VALUES												
Determined as of the last day of the month indicated (\$US/kg U as UF6)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90	25.25	24.40	24.40								

US UF6 PREMIUM (Relative to the UF6 Value)												
Determined as of the last day of the month indicated (\$US/kg U as UF6)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	Discontinued	

TRANSACTION VALUES												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25	9.05	8.75	8.65								

HISTORICAL MARKET DATA
LOAN RATES

Determined as of the last day of the month indicated (Percent per Annum)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50	3.50	3.50	3.50								

* Float with Prime Rate

CONVERSION VALUES

Determined as of the last day of the month indicated (\$US/lb U as UF6)

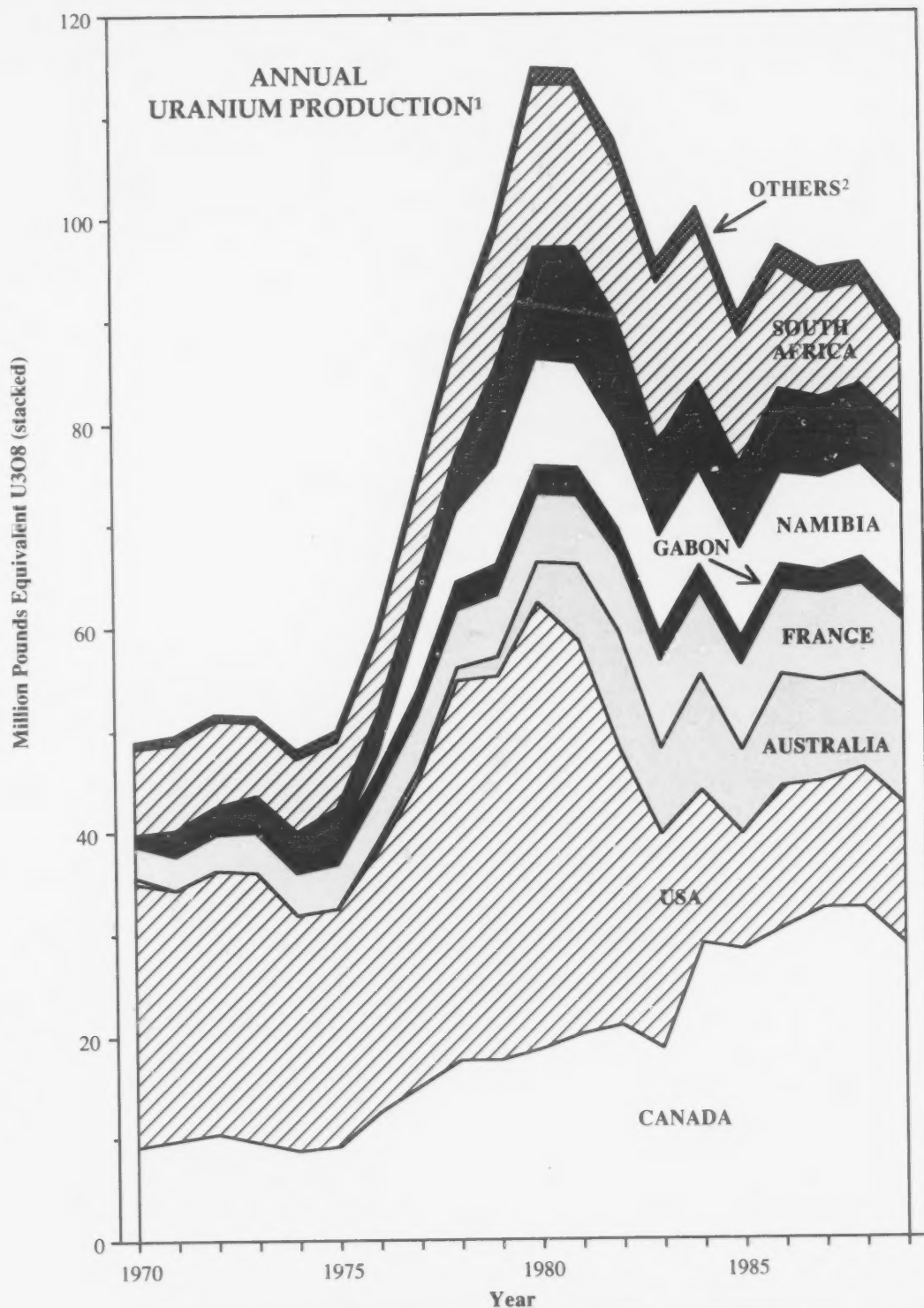
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.50	1.50	1.45	1.45								

SWU VALUES

Determined as of the last day of the month indicated (\$US per SWU)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54	50	50	50								

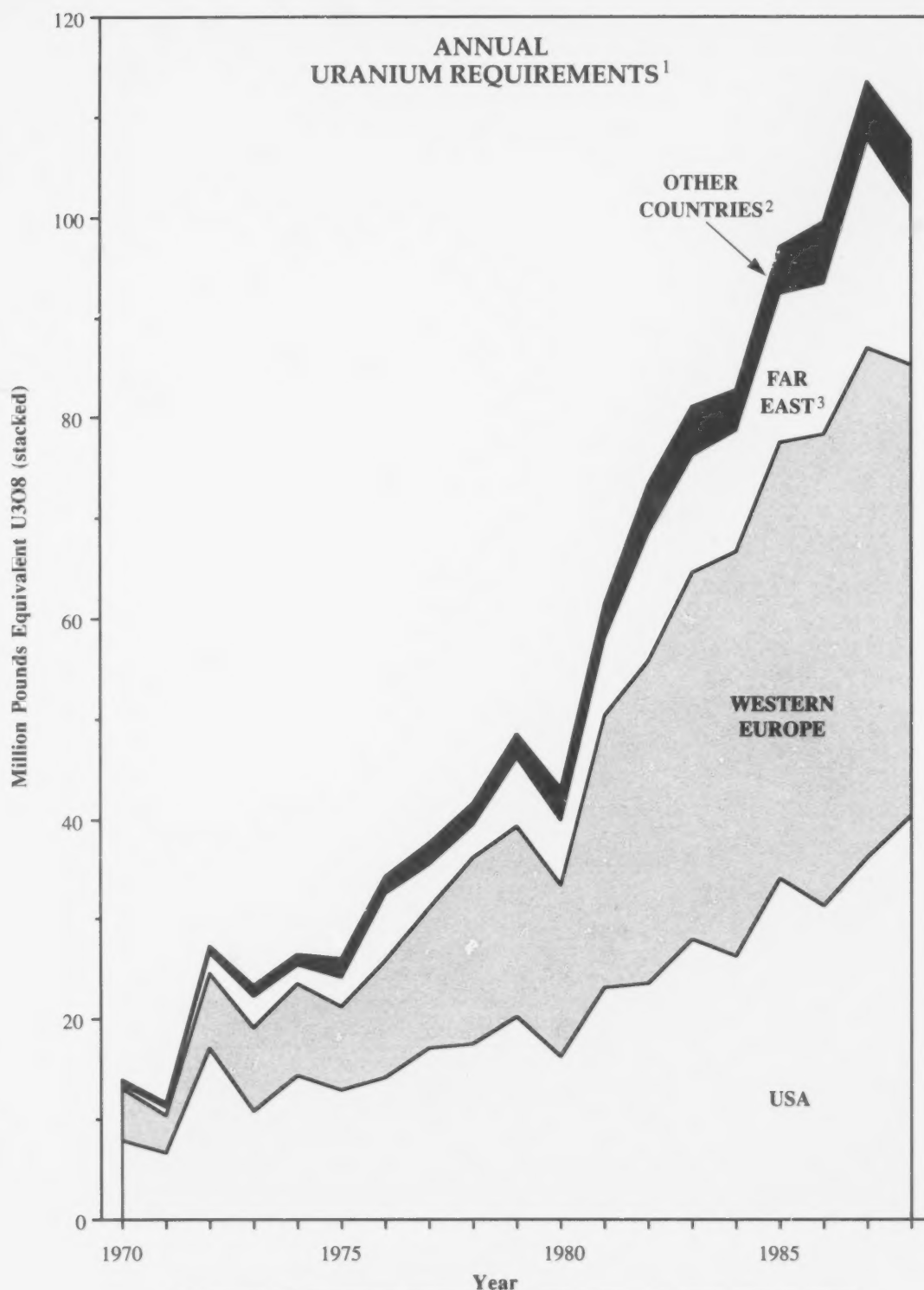
HISTORICAL MARKET DATA



¹ Estimated world production in 1989 totalled 89.6 million pounds (Australia—9.5; Canada—28.7; France—8.5; Gabon—2.2; Namibia—9.2; Niger—7.7; South Africa—7.7; USA—13.7; Others²—2.3).

² Others includes: Argentina, Belgium, Brazil, India, Pakistan, Portugal, Spain, West Germany and Yugoslavia

HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

² Other Countries include: Argentina, Brazil, Canada, India, Mexico, Pakistan and South Africa.

³ Does not include Peoples Republic of China.

GOVERNMENT STATISTICS

AUSTRALIA					
		Consumer Price Index ¹ (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ² (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia (Australian dollars) ⁶	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates ³ (June 1985=100)
1980	Avg.	95.8	83.1	—	140.8 ⁵
1981	Avg.	105.0	85.9	—	154.1 ⁵
1982	Avg.	116.7	89.0	—	174.9 ⁵
1983	Avg.	128.5	96.9	—	181.9 ⁵
1984	Avg.	133.6	98.0	—	194.4 ⁵
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
Jan	1989	—	110.6	—	122.2
Feb	1989	—	111.2	521.90	122.2
Mar	1989	188.0	114.9	—	123.1
Apr	1989	—	117.5	—	123.2
May	1989	—	118.6	530.40	123.7
June	1989	192.6	119.9	—	124.7
July	1989	—	120.1	—	126.2
Aug	1989	—	119.2	539.30	126.2
Sept	1989	197.0	117.7	—	126.3
Oct	1989	—	117.8	—	126.5
Nov	1989	—	118.0	547.20	126.8
Dec	1989	—	118.2	—	126.8
Jan	1990	—	119.2	—	126.8
Feb	1990	—	120.8	—	127.2

P = Preliminary R = Revised since last month

¹Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

²Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

³Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

⁴Monthly data for the period 1967 to 1986 appear in Report 233.

⁵Base: June 1976 = 100.

⁶Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

GOVERNMENT STATISTICS

CANADA								
Wage-earner Data: Average Hourly Earnings (C\$) ²								
Industrial Products Price Index: All Commodities ¹ (1981 = 100)		Consumer Price Index: All Items (1981 = 100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells ³ (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)	
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	138.2	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	143.8	20.91	18.51	16.95	13.17	13.77
Jan	1989	130.7	146.8	21.22	19.45	18.14	13.75	13.82
Feb	1989	130.8	147.8	22.05	19.51	18.26	13.79	13.89
Mar	1989	131.3	148.5	21.90	19.65	18.35	13.62	14.10
Apr	1989	131.3	149.0	22.37	19.80	18.40	13.57	14.16
May	1989	131.4	150.5	21.89	20.02	18.17	13.76	14.27
June	1989	131.5	151.3	21.89	20.02	18.17	13.76	13.22
July	1989	131.4	152.3	21.67	19.60	17.96	13.57	12.98
Aug	1989	131.3	152.4	20.97	19.76	18.24	13.52	14.30
Sept	1989	131.0	152.6	21.97	20.61	18.73	13.68	14.83
Oct	1989	130.8	153.2	22.26	20.71	18.74	13.99	14.77
Nov	1989	130.6	153.7	22.60	20.64	18.78	13.93	14.75
Dec	1989	130.2	153.6	22.80	20.50	18.93	13.62	14.77
Jan	1990	130.4	154.9	21.88	20.39R	19.03R	13.99	14.78R
Feb	1990	131.3	155.8	22.51P	20.56P	19.09P	14.49P	15.04P
Mar	1990	131.6	156.3	—	—	—	—	—

P = Preliminary R = Revised since last month

¹Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

²Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

³Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

GOVERNMENT STATISTICS

SOUTH AFRICA						
		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand) ¹	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100) ²	Consumer Price Index ³ (1985 = 100)	Production Price Index All Groups ⁴ (1985 = 100)	Total Salaries and Wages in Mining and Quarrying ⁵ (1,000 Rand) ⁵
1980	Avg.	35.53	—	51.9	55.2	2,237,689
1981	Avg.	41.89	—	59.8	62.7	2,756,928
1982	Avg.	47.25	104.2	68.6	71.4	3,181,584
1983	Avg.	51.88	115.0	77.1	79.0	3,563,282
1984	Avg.	58.95	130.3	86.0	85.6	4,134,390
1985	Avg.	68.76	151.6	100.0	100.0	4,778,612
1986	Avg.	80.22	177.9	118.6	119.5	5,767,950
1987	Avg.	95.01	223.1	137.7	136.2	6,911,395
1988	Avg.	106.69	241.1	155.4	154.1	7,774,054
Jan	1989	—	—	166.8	165.5	714,593
Feb	1989	—	—	168.2	168.5	696,329
Mar	1989	112.29	262.8	170.9	171.1	702,746
Apr	1989	—	—	173.1	173.8	658,677
May	1989	—	—	175.9	176.4	706,056
June	1989	113.76	267.0	177.7	177.1	706,810
July	1989	—	—	179.3	178.8	711,648
Aug	1989	—	—	181.8	180.7	703,812
Sept	1989	119.76	280.2	183.4	181.7	708,222
Oct	1989	—	—	185.1	183.9	689,017
Nov	1989	—	—	187.0	185.6	—
Dec	1989	120.79	282.0	189.4	187.2	—
Jan	1990	—	—	192.0	188.8	—
Feb	1990	—	—	193.3	190.3	—
Mar	1990	—	—	196.4	—	—

P = Preliminary R = Revised since last month

¹Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

²Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

³Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 236.

⁴Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

⁵Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

GOVERNMENT STATISTICS

UNITED STATES									
		Producer Price Index ¹		Consumer Price Index ²	GNP Implicit Price Deflator ³	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
Jan	1989	109.4	110.5	121.1	—	13.80	13.49	12.85	10.27
Feb	1989	110.1	110.8	121.6	—	13.66	13.48	12.88	10.26
Mar	1989	110.5	111.5	122.3	125.4	13.71	13.51	12.91	10.30
Apr	1989	111.8	112.3	123.1	—	13.68	13.65	12.92	10.31
May	1989	112.1	113.2	123.8	—	13.60	13.57	12.98	10.33
June	1989	112.4	112.9	124.1	126.0	13.62	13.66	12.98	10.37
July	1989	112.2	112.8	124.4	—	13.70	13.75	13.12	10.41
Aug	1989	111.4	112.0	124.6	—	13.64	13.72	13.08	10.40
Sept	1989	111.9	112.4	125.0	126.8	13.70	13.99	13.18	10.47
Oct	1989	112.4	112.8	125.6	—	13.76	13.94	13.25	10.43
Nov	1989	112.2	112.7	125.9	—	13.69	14.12	13.26	10.47
Dec	1989	112.3	113.0	126.1	128.0	13.51	14.16	13.31	10.52
Jan	1990	114.2	114.9	127.4	—	13.75R	13.95R	13.31R	10.50R
Feb	1990	113.6	114.4	128.0	—	13.75P	14.00P	13.21R	10.53R
Mar	1990	113.2	114.2	128.7	129.7	—	—	13.28P	10.53P

P = Preliminary R = Revised since last month

¹US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

²US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

³US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

⁴US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

GOVERNMENT STATISTICS

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	\$16.10	3.6	n/a	1.2
1977	29.9	27.8	\$19.75	5.6	n/a	4.0
1978	37.0	31.6	\$21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agents

³ Includes imports by domestic utilities and domestic suppliers

GOVERNMENT STATISTICS

**VOLUME AND PRICE OF URANIUM DELIVERIES
TO THE EUROPEAN COMMUNITY¹**
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC ² (in MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ^{3,4}		Spot Contracts ^{3,4}	
			Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈	Average Price in ECU per pound U ₃ O ₈	Average Price in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,500	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65R	\$16.13R

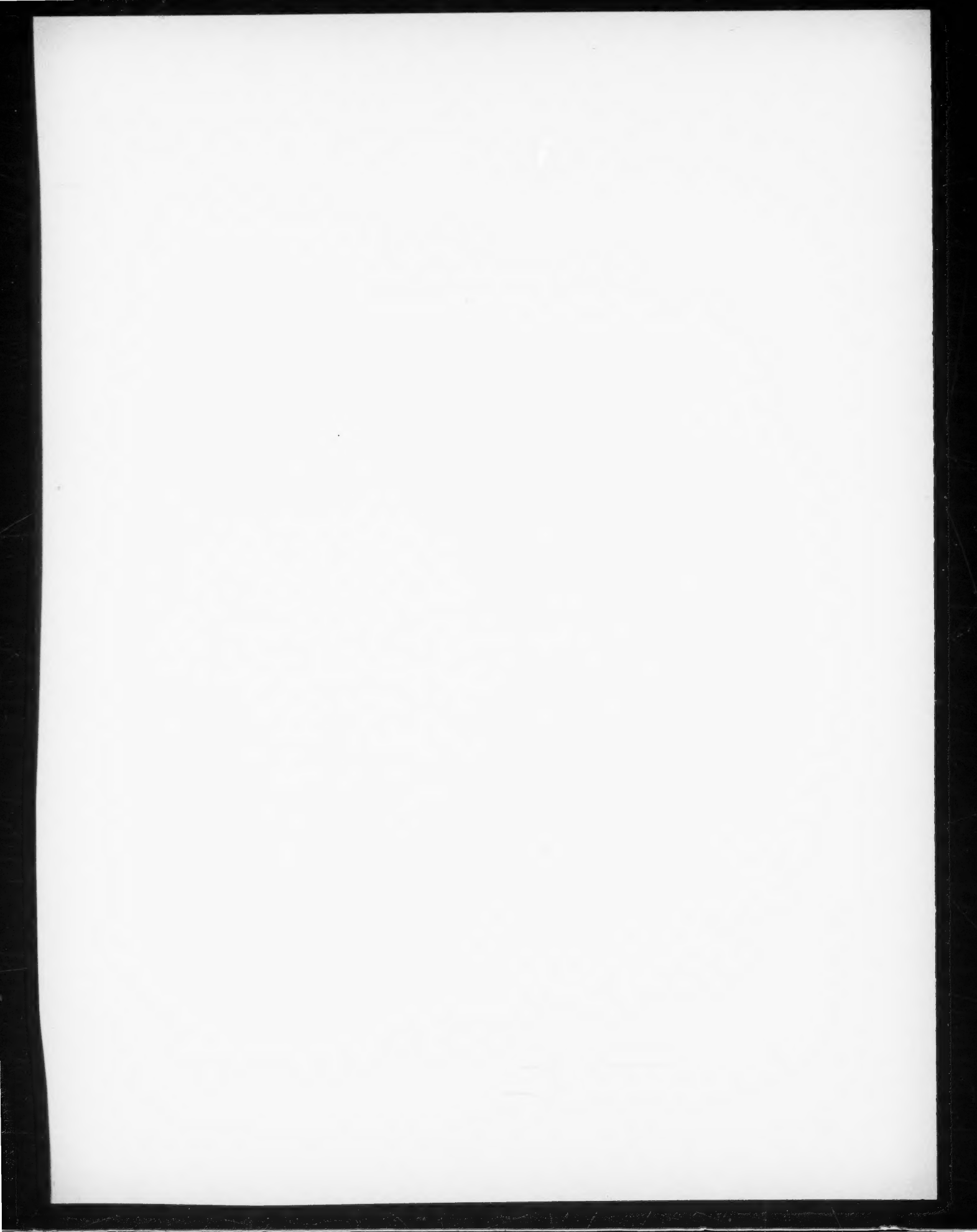
R = Revised

¹The twelve European Community member nations are Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

²The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar.

⁴Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.



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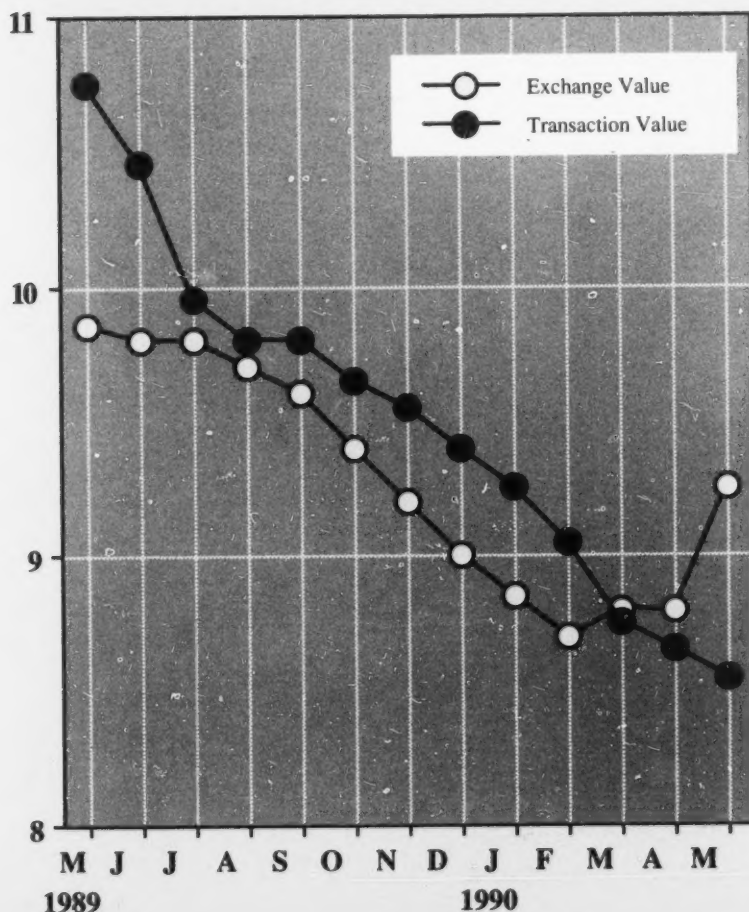
NUEXCO

Monthly Report

June 1990

Number 262

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To Our Readers

NUEXCO announces the May 31 retirement of James G. Munro, who has been our representative in Australia since early 1987. Jim has made invaluable contributions to our organization, and we extend him our best wishes for the future. A new organizational arrangement for NUEXCO's presence in the Australian market will be announced soon.

*

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We would also like to draw your attention to format changes that have been implemented beginning with this issue of the Monthly Report. The separate Executive Summary and Figures of the Month insert has been discontinued. The information contained in these sections has been retained and is located within the Market Review section. We hope you will find these reformatting changes result in a clearer and more concise presentation of market activity.

MARKET REVIEW
MARKET VALUES SUMMARY
May 31, 1990

NUEXCO Market Values	This Report May 31, 1990	Last Report April 30, 1990	12 Months Ago May 31, 1989
EXCHANGE VALUE¹	\$9.25/lb equivalent U₃O₈	\$8.80	\$9.85
UF₆ VALUE²	\$25.50/kg U as UF₆	\$24.40	\$30.25
LOAN RATE³	3.5 %/annum	3.5%	3.5%
CONVERSION VALUE⁴	\$1.45/lb U as UF₆	\$1.45	\$1.95
SWU VALUE⁵ (0.3 tails assay)	\$50 /SWU	\$50	\$66
TRANSACTION VALUE⁶	\$8.55 /lb equivalent U₃O₈	\$8.65	\$10.75
Transactions	27	24	31
Months	3	3	3
million pounds	9.9	8.4	7.1

DEFINITIONS

¹ The Exchange Value is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

² The UF₆ Value is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

³ The Loan Rate is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

⁴ The Conversion Value is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

⁵ The SWU Value is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

⁶ The Transaction Value is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:

- Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
- At least ten transactions;
- Transactions involving a sum total of at least 2 million pounds equivalent U₃O₈.

DERIVATIONS AND COMMENTS

• All Market Values are expressed in terms of US\$.

• All Market Values are based on:

- Data from recently completed transactions.
- Data from pending transactions.
- Firm bids to buy or borrow, and firm offers to sell or lend.
- Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend.

• Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these Market Values.

• In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers.

• The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.

• For the SWU Value, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the NUEXCO Exchange Value and Conversion Value determined as of the same date.

• In calculating the Transaction Value, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined.

• The sample time for the Transaction Value is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

MARKET REVIEW

MAY MARKET REVIEW

(as of May 31, 1990)

NATURAL URANIUM AND CONVERSION

Short-term Market Activity

Both the Exchange Value and the UF₆ Value increased significantly on May 31, 1990, marking the first time since October 1987 that both Values have increased. It also marks the first time in exactly five years that the Exchange Value and the UF₆ Value have both increased by approximately five percent in the same month. Over four million pounds equivalent U₃O₈ changed hands in May's eleven near-term natural uranium sales. Six involved concentrates, five involved natural UF₆ (Table 1), and the closing prices fell within a wide range (88% to 107% of the Exchange Value or UF₆ Value).

Prices tended to increase throughout the month, as both buyers and sellers began to sense that a general strengthening of the natural uranium market may be underway. The uranium market is in transition, and as a result, uncertainty in the market is greater than normal. Furthermore, geographical differences in market conditions are aggravating this uncertainty.

The May 31 Exchange Value increased for the second time in three months, rising sharply to \$9.25 per pound U₃O₈, up \$0.45 (a 5.1 percent increase) from the April 30 Exchange Value. This is the first time since July 31, 1985 that the Exchange Value has risen by five percent or more in a single month. Six concentrates sales totalled over 1.5 million pounds equivalent U₃O₈ and occurred at prices that varied widely around the May 31 Exchange Value. This diversity of price levels was due to the upward price movement during the month, and to the difference between market conditions in Europe and North America. Demand is lower in Europe, so buyers can be more selective and command lower prices from aggressive sellers. In North America, higher demand and tighter supply have enabled some sellers to command prices above the May 31 Exchange Value in recent sales.

The UF₆ Value increased for the first time since October 1987, jumping \$1.10 to \$25.50 per KgU as UF₆. This increase of 4.5 percent is the largest increase in the UF₆ Value since May 31, 1985, which was only the second month of its publication. Intermediaries sold a total of 2.5 million pounds equivalent U₃O₈ in May's five spot natural UF₆ sales. The dichotomy between market conditions in Europe and North America is even more pronounced for UF₆. Lower demand, high inventories, and aggressive competition have kept UF₆ prices lower in Europe. In contrast, the UF₆ glut that has been prevalent in North America in recent months has been reduced significantly. As a result, North American UF₆ buyers, particularly those imposing special restrictions, may have to settle for prices above the May 31 UF₆ Value, and may receive even higher offers.

* * *

The Transaction Value declined to \$8.55 per pound U₃O₈ based on 27 transactions over 3 months involving 9.9 million pounds. When UF₆ sales are included in the calculation of the Transaction Value, the effective prices of their U₃O₈ components reflect the market's discount or premium for UF₆. (Explained in detail last month—Report No. 261, pages 2-3.) Under current market conditions, UF₆ is selling at a discount relative to the sum of the

Table 1
SPOT URANIUM SALES SUMMARY

	May 1990		Year-to-Date	
	No. of Sales	Volume ¹	No. of Sales	Volume ¹
Concentrates	6	1.7	23	7.2
UF ₆	5	2.5	15	8.0
EUP	2	1.0	8	3.9
Total	13	5.2	46	19.1

¹ Million Pounds Equivalent U₃O₈

MARKET REVIEW

values of its components—concentrates and conversion. Thus, the concentrates component of a UF₆ sale is discounted when used to calculate the Transaction Value and contributes to holding the Transaction Value below the Exchange Value. However, if UF₆ were selling at a premium relative to the sum of the values of its components, UF₆ sales would tend to hold the Transaction Value above the Exchange Value.

The May 31 Transaction Value also lags the Exchange Value because the qualifying transactions from May, April, and March are all included in the calculation. These sales, which were concluded at the market's previously lower levels, contribute to the lower Transaction Value.

* * *

Active uranium supply increased to 3.5 million pounds equivalent U₃O₈, while active uranium demand declined to 3.7 million pounds equivalent U₃O₈ (Table 2). The resultant supply/demand ratio is 0.9. Subject to geographical variances, demand exceeds supply for the third consecutive month. However, recent history has demonstrated that price increases bring previously unidentified supply sources into the market each month as necessary to meet demand. On the other hand, although new supply enters the market as expected, some current

supply sources tighten in anticipation of higher prices in the future. So uncertainty again prevails in today's transitory market.

* * *

Long-Term Market Activity

Five long-term uranium sales are reported this month, two of which occurred in 1989. Producers sold over nine million pounds equivalent U₃O₈ in the three May sales. Most of these sales utilized either base-price escalated or market-related pricing terms. The recent upward trend in spot prices has also been paralleled by a rise in prices for deliveries beyond 12 months.

* * *

The **Loan Rate** remained at 3.5 percent per annum. Six natural uranium loans, three involving UF₆, and three involving concentrates, were concluded in May. Three of the loans occurred at or near the May 31 Loan Rate; the remaining loans were portions of more complex transactions and involved special considerations. When those considerations are appraised, the loans can be evaluated at levels near the Loan Rate.

The six loans totalled nearly 2.5 million pounds equivalent U₃O₈; the UF₆ loans totalled nearly one million pounds, and three concentrates loans made up the balance of the volume. Four of the six lenders are located in Europe; the majority of the borrowers are from the USA.

* * *

The **Conversion Value** remained unchanged at \$1.45 per pound U as UF₆. Two European buyers purchased conversion services for nearly one million pounds of U as UF₆ from intermediaries, for prices at or near the May 31 Conversion Value. The downward pressure on secondary conversion services has alleviated somewhat. However, the geographical differences in the uranium market are now beginning to affect conditions in the conversion market and inquiries for secondary conversion services reflect price level expectations that differ between North America and Europe.

Table 2
NEAR-TERM SUPPLY/DEMAND SUMMARY

	Active Supply ¹	Active Demand ¹
• Natural Uranium ² (thousand lbs equivalent U ₃ O ₈)	3,475	3,670
• Supply/Demand Ratio:	0.9	
• Loans (thousand lbs equivalent U ₃ O ₈)	7,210	0
• Conversion (thousand lbs U as UF ₆)	150	1,500
• SWU (thousand SWUs)	935	165

¹ Supply and demand tables in the current market data section of this Report provide details for each category.
² Includes concentrates and hexafluoride.

MARKET REVIEW

**ENRICHMENT SERVICES AND
ENRICHED URANIUM PRODUCT**

The **SWU Value** has not changed since February 28, 1990, remaining at **\$50** per SWU. Four spot SWU sales took place in May at or near the prevailing SWU Value. The sales totalled nearly 400 thousand SWU, with European entities as the buyers and sellers in three of the

transactions. SWU supply seemed to tighten temporarily during the month, but large quantities of excess SWU inventories are known to exist. One long-term SWU sale also occurred in May for almost 1.7 million SWU in EUP using base-price-escalated terms.

Two utilities purchased a total of nearly one million pounds equivalent U_3O_8 in EUP in two near-term sales that also occurred in May. ■

**Table 3
ENRICHMENT PRICES
(May 31, 1990)**

Prices	This Month Report 262	Last Month Report 261	12 Months Ago Report 250
NUEXCO SWU Value (\$US per SWU)	50	50	66
US DOE SWU prices: (\$US per SWU)			
USEC	117.85 ¹	117.85 ¹	117.00 ²
AFC	153.00 ³	153.00 ³	153.00 ³
Requirements	157.00 ³	157.00 ³	157.00 ³
Incentive Price (IP1)	90.00 ⁴	90.00 ⁴	90.00 ⁴
Calculated worth of enriched $UF_6$⁵: (\$US per kg U as UF_6)			
2.5 w/o U_{235}	274	267	328
3.0 w/o U_{235}	351	343	423
3.5 w/o U_{235}	430	421	520
4.0 w/o U_{235}	510	500	619

¹ Effective 10/1/89 to 9/30/90.
² Effective 10/1/87 to 9/30/89.
³ Effective since 10/1/84.
⁴ Effective 10/1/86 to 9/30/90, for up to 30% of annual requirements.
DOE chose to waive application of the GNP deflator for FY87-FY90 deliveries.
⁵ Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 w/o tails assay.

MARKET REVIEW

RECENT TRANSACTIONS

URANIUM SALES¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U₃O₈ equivalent)	Approximate Price Range² as Percent of Current Exchange or UF₆ Value	Buyer	Seller	Remarks
4826	1993 - 1998	1,001 - 3,000	See Remarks	Utility	Producer	Occurred in 1989, Price Related to Market
4827A	1990 - 1999	5,001 - 10,000	R ³	Utility	Producer	Contained in EUP
4829	1992 - 1994	601 - 1,000	See Remarks	Utility	Producer	Price Related to Market
4830	1993 - 1998	601 - 1,000	R ³	Utility	Producer	Occurred in 1989
4831	1990	301 - 600	98 - 102	Utility	Intermediary	
4832	1991	601 - 1,000	88 - 92	Utility	Intermediary	UF ₆
4833	1990	Less than 50	88 - 92	Utility	R ³	
4834	1990	101 - 300	98 - 102	Producer	Intermediary	
4835	1990	101 - 300	93 - 97	Utility	Intermediary	UF ₆
4836	1990	101 - 300	98 - 102	R ³	Producer	
4839	1991	101 - 300	103 - 107	Producer	Intermediary	
4840	1990	1,001 - 3,000	93 - 97	Utility	Intermediary	UF ₆
4841A	1990	601 - 1,000	R ³	Utility	R ³	Contained in EUP
4844	1991	301 - 600	93 - 97	Intermediary	Intermediary	UF ₆
4847A	1990	101 - 300	R ³	Utility	R ³	Contained in EUP
4848	1990	101 - 300	98 - 102	Intermediary	Intermediary	UF ₆
4853	1992 - 1995	301 - 600	R ³	R ³	Producer	
4855	1990	101 - 300	103 - 107	Utility	R ³	

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.



MARKET REVIEW

URANIUM LOANS¹

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U ₃ O ₈ equivalent)	Approximate Price Range ² as Percent of Current Loan Rate	Borrower	Lender	Remarks
4824	1990	301 - 600	98 - 102	R ³	Producer	UF ₆
4825	1990	101 - 300	98 - 102	Intermediary	Utility	UF ₆
4837	1990	301 - 600	R ³	Intermediary	R ³	UF ₆
4849	1990	601 - 1,000	R ³	Intermediary	Utility	Concentrates
4851	1990	301 - 600	113 - 117	Intermediary	Producer	Concentrates
4854	1990	101 - 300	98 - 102	Intermediary	Producer	Concentrates

CONVERSION SERVICES SPOT MARKET SALES¹

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U equivalent)	Approximate Price Range ² as Percent of Current C.V.	Buyer	Seller	Remarks
4845	1990	301 - 600	98 - 102	Utility	Intermediary	
4846	1990 - 1991	301 - 600	98 - 102	Utility	Intermediary	

ENRICHMENT SERVICES SECONDARY MARKET SALES¹

NUEXCO Transaction Period	Delivery Period	Approximate Quantity ⁴ (thousand SWUs)	Approximate Price Range ² as Percent of Current SWU Value ⁵	Buyer	Seller	Remarks
4827B	1990 - 1999	1,001 - 3,000	R ³	Utility	Producer	Contained in EUP
4838	1990	101 - 300	98 - 102	Intermediary	Utility	
4841B	1990	101 - 300	R ³	Utility	R ³	Contained in EUP
4842	1990	50 - 100	98 - 102	Utility	Intermediary	
4847B	1990	50 - 100	R ³	Utility	R ³	Contained in EUP

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

⁴ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 % tails assay.

⁵ Prices are usually normalized to 0.30 % tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

SUPPLY AND DEMAND

URANIUM SUPPLY (May 31, 1990)				
NUEXCO Project Number	Quantity (Thousand Pounds equivalent U ₃ O ₈)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Available for Sale				
ACTIVE				
89-1201	1,300	2,000 per year	1990 - 1993	
90-1078A*	2,175	2,175 per year	1991 - 1993	UF ₆ e
90-1027*	—	1,300 per year	1991-2000	
Total	3,475			
INACTIVE				
89-1076	500	250 per year	1990 on	
89-1156	200	—	1990	
89-1180	1,000	—	1990	
87-1123	—	1,000 per year	1990 on	
88-1157	—	1,000 per year	1990 on	UF ₆
Total	1,700			
* New or revised since last month.				
¹ For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.				
² For delivery beyond one year, measured from the date of this Report.				
Projects removed since last month: 87-1000, 89-1173, 89-1209.				



MARKET REVIEW

URANIUM DEMAND (May 31, 1990)				
NUEXCO Project Number	Quantity (Thousand Pounds equivalent U ₃ O ₈)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Inquiries to Purchase: ACTIVE				
90-1038*	520	—	1990	
90-1077*	500	—	1990 - 1991	
90-1100A	45	—	1991	UF ₆ e
90-1113*	185	525 per year	1991 - 1995	U ₃ O ₈ /UF ₆
90-1114*	75	—	1990	U ₃ O ₈ /UF ₆
90-1119*	195	—	1990	UF ₆
90-1120*	30	105 per year	1991 - 1992	UF ₆
90-1121*	500	—	1990	U ₃ O ₈ /UF ₆
90-1125*	720	—	1990 - 1991	U ₃ O ₈ /UF ₆
90-1126*	350	—	1991	
90-1138*	350	—	1990	
90-1139*	200	—	1990	
.....				
89-1233	—	160	1991	UF ₆
90-1024	—	250 per year	1992 - 2001	
90-1092A	—	325	1991 - 1992	UF ₆ e
90-1093A	—	390	1991 - 1992	UF ₆ e
90-1098	—	250 per year	1992 - 1994	
90-1111*	—	390	1992	UF ₆
Total	3,670			
INACTIVE				
89-1067	500	—	1990	
89-1175	170	170 per year	1990 - 1991	
90-1045A	405	—	1991	UF ₆ e
90-1099	265	—	1990	
.....				
90-1017	—	250	1991	
Total	1,340			
.....				
* New or revised since last month.				
¹ For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.				
² For delivery beyond one year, measured from the date of this Report.				
Projects removed since last month: 89-1183, 90-1026, 90-1064, 90-1082, 90-1085A, 90-1102, 90-1103.				

MARKET REVIEW

LOAN SUPPLY AND DEMAND (May 31, 1990)			
NUEXCO Project Number	Quantity (Thousand Pounds equivalent U ₃ O ₈)		Remarks
	Within 1 Year ¹	Beyond 1 Year ¹	
Available for Loan			
ACTIVE			
88-1182	4,000	—	U ₃ O ₈ /UF ₆
90-1016	300	—	U ₃ O ₈
90-1033	1,270	—	UF ₆
90-1108	1,000	—	U ₃ O ₈
90-1110*	250	—	U ₃ O ₈
90-1115*	390	—	UF ₆
Total	7,210		
INACTIVE			
90-1031*	1,000	—	U ₃ O ₈
90-1049	1,000	—	U ₃ O ₈
Total	2,000		
Inquiries to Borrow:			
No inquiries to borrow are reported			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 90-1096.			



MARKET REVIEW

CONVERSION SUPPLY AND DEMAND (May 31, 1990)			
NUEXCO Project Number	Quantity (Thousand Pounds U as UF ₆)		Remarks
	Within 3 Years ¹	Beyond 3 Years ¹	
Available for Loan			
ACTIVE			
89-7002	150	—	
Total	150		
INACTIVE			
None reported			
Inquiries to Purchase			
ACTIVE			
90-1101	500	—	
90-1122*	845	—	
90-1137*	155	—	
Total	1,500		
INACTIVE			
None reported			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 90-1072, 90-1075.			

MARKET REVIEW

SWU SUPPLY AND DEMAND (May 31, 1990)				
NUEXCO Project Number	Quantity (Thousand SWUs)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Available for Sale				
ACTIVE				
90-1078B*	435	435 per year	1991 - 1993	UF6e
90-7000*	500	1,000	1990 on	
Total	935			
INACTIVE				
None reported				
Inquiries to Purchase				
ACTIVE				
90-1071	150	150 per year	1991 - 1996	
90-1100B	15	—	1991	UF6e
88-1061	—	500	1991 - 1995	
89-1262	—	120 per year	1996 - 1999	
90-1022A	—	235 per year	1996 - 1999	
90-1022B	—	900 per year	2000 - 2013	
90-1076	—	350 per year	1992 - 1998	
90-1092B	—	150	1991 - 1992	UF6e
90-1093B	—	200	1991 - 1992	UF6e
90-1094*	—	500	1992 - 2000	
90-1109*	—	170	1996	
Total	165			
INACTIVE				
90-1045B	95	—	1991	UF6e
90-1079*	1,450	—	1990	
89-1047	—	600	1991 - 1995	
Total	1,545			
* New or revised since last month.				
¹ For delivery within one year, measured from the date of this Report. This category excludes SWU deliverable within one year under other than spot or near-term contracts.				
² For delivery beyond one year, measured from the date of this Report.				
Projects removed since last month: 88-1082, 90-1035, 90-1052, 90-1073, 90-1080, 90-1085B.				

MARKET REVIEW

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

EXCHANGE VALUE ¹						
Country (currency)	per lb equivalent U3O8 as Concentrates			per kg U as Concentrates		
	This Month (May 31, 1990)	Last Month (Apr 30, 1990)	12 Months Ago (May 31, 1989)	This Month (May 31, 1990)	Last Month (Apr 30, 1990)	12 Months Ago (May 31, 1989)
Australia (dollar)	11.98	11.69	13.16	31.14	30.40	34.21
Belgium (franc)	320.18	304.50	412.13	832.40	791.63	1,071
Canada (dollar)	10.88	10.24	11.89	28.28	26.62	30.91
EEC (ecu)	7.54	7.24	8.93	19.59	18.82	23.21
Finland (markka)	36.40	34.82	43.80	94.63	90.53	113.86
France (franc)	52.50	49.49	66.69	136.48	128.67	173.38
Italy (lira)	11,451	10,815	14,236	29,770	28,116	37,010
Japan (yen)	1,400	1,402	1,408	3,641	3,645	3,660
Netherlands (guilder)	17.52	16.59	22.18	45.55	43.13	57.66
So. Africa (comm. rand)	24.54	23.39	27.45	63.79	60.80	71.37
Spain (peseta)	965.65	933.29	1,261	2,510	2,426	3,278
Sweden (krona)	56.20	53.56	66.15	146.10	139.25	171.98
Switzerland (franc)	13.17	12.80	17.14	34.23	33.29	44.56
UK (pound)	5.45	5.38	6.28	14.18	13.99	16.32
US (dollar)	9.25	8.80	9.85	24.05	22.88	25.61
West Germany (mark)	15.57	14.77	19.67	40.47	38.39	51.14

TRANSACTION VALUE ¹						
Country (currency)	per lb equivalent U3O8 as Concentrates			per kg U as Concentrates		
	This Month (May 31, 1990)	Last Month (Apr 30, 1990)	12 Months Ago (May 31, 1989)	This Month (May 31, 1990)	Last Month (Apr 30, 1990)	12 Months Ago (May 31, 1989)
Australia (dollar)	11.07	11.50	14.36	28.79	29.88	37.34
Belgium (franc)	295.95	299.31	449.79	769.40	778.13	1,169
Canada (dollar)	10.06	10.06	12.98	26.14	26.16	33.73
EEC (ecu)	6.96	7.11	9.74	18.11	18.50	25.33
Finland (markka)	33.64	34.23	47.80	87.47	88.98	124.27
France (franc)	48.52	48.65	72.78	126.15	126.47	189.22
Italy (lira)	10,584	10,630	15,537	27,517	27,637	40,393
Japan (yen)	1,294	1,378	1,536	3,365	3,583	3,994
Netherlands (guilder)	16.20	16.31	24.21	42.11	42.39	62.93
So. Africa (comm. rand)	22.68	22.99	29.96	58.96	59.76	77.89
Spain (peseta)	892.58	917.38	1,376	2,321	2,385	3,577
Sweden (krona)	51.94	52.65	72.20	135.04	136.87	187.69
Switzerland (franc)	12.17	12.59	18.71	31.64	32.72	48.63
UK (pound)	5.04	5.29	6.85	13.11	13.75	17.81
US (dollar)	8.55	8.65	10.75	22.23	22.49	27.95
West Germany (mark)	14.39	14.52	21.47	37.41	37.74	55.82

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

MARKET REVIEW
CONVERSION VALUE¹

Country (currency)	per lb U as UF ₆			per kg U as UF ₆		
	This Month (May 31, 1990)	Last Month (Apr 30, 1990)	12 Months Ago (May 31, 1989)	This Month (May 31, 1990)	Last Month (Apr 30, 1990)	12 Months Ago (May 31, 1989)
Australia (dollar)	1.88	1.93	2.61	4.14	4.25	5.74
Belgium (franc)	50.19	50.17	81.59	110.65	110.61	179.87
Canada (dollar)	1.71	1.69	2.35	3.76	3.72	5.19
EEC (ecu)	1.18	1.19	1.77	2.60	2.63	3.90
Finland (markka)	5.71	5.74	8.67	12.58	12.65	19.12
France (franc)	8.23	8.15	13.20	18.14	17.98	29.11
Italy (lira)	1,795	1,782	2,818	3,957	3,929	6,213
Japan (yen)	219.53	231.00	278.69	483.98	509.27	614.41
Netherlands (guilder)	2.75	2.73	4.39	6.06	6.03	9.68
So. Africa (comm. rand)	3.85	3.85	5.43	8.48	8.50	11.98
Spain (peseta)	151.37	153.78	249.60	333.72	339.03	550.27
Sweden (krona)	8.81	8.83	13.10	19.42	19.46	28.87
Switzerland (franc)	2.06	2.11	3.39	4.55	4.65	7.48
UK (pound)	.85	0.89	1.24	1.88	1.95	2.74
US (dollar)	1.45	1.45	1.95	3.20	3.20	4.30
West Germany (mark)	2.44	2.43	3.89	5.38	5.36	8.59

SWU VALUE AND UF₆ VALUE¹

Country (currency)	SWU Value at 0.30% Tails Assay			UF ₆ Value per kg U as UF ₆		
	This Month (May 31, 1990)	Last Month (Apr 30, 1990)	12 Months Ago (May 31, 1989)	This Month (May 31, 1990)	Last Month (Apr 30, 1990)	12 Months Ago (May 31, 1989)
Australia (dollar)	64.75	66.45	88.18	33.02	32.43	40.41
Belgium (franc)	1,731	1,730	2,762	882.66	844.29	1,266
Canada (dollar)	58.80	58.17	79.66	29.99	28.39	36.51
EEC (ecu)	40.73	41.13	59.81	20.77	20.07	27.41
Finland (markka)	196.75	197.85	293.46	100.34	96.55	134.50
France (franc)	283.77	281.20	446.85	144.72	137.23	204.80
Italy (lira)	61,897	61,448	95,390	31,567	29,986	43,720
Japan (yen)	7,570	7,966	9,433	3,861	3,887	4,323
Netherlands (guilder)	94.71	94.25	148.62	48.30	45.99	68.11
So. Africa (comm. rand)	132.63	132.87	183.95	67.64	64.84	84.30
Spain (peseta)	5,220	5,303	8,448	2,662	2,588	3,872
Sweden (krona)	303.77	304.32	443.25	154.92	148.51	203.15
Switzerland (franc)	71.17	72.75	114.84	36.30	35.50	52.63
UK (pound)	29.48	30.57	42.05	15.04	14.92	19.27
US (dollar)	50.00	50.00	66.00	25.50	24.40	30.25
West Germany (mark)	84.15	83.91	131.82	42.91	40.95	60.41

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

RECENT DEVELOPMENTS

RECENT DEVELOPMENTS

USA

Smith Barney Report Released

The US Department of Energy (DOE) released on May 18 an executive summary of the independent financial study conducted by Smith Barney Harris Upham & Co. Inc. (Smith Barney) recommending the eventual privatization of the DOE enrichment program. DOE commissioned the assessment to obtain an objective view of the uranium enrichment enterprise (UEE) and an independent opinion as to the best way to maximize its financial value to the US Treasury. The report found the UEE constrained by pricing inflexibility, the government's short-term budget and planning process, conflicting congressional mandates and administration objectives, a lengthy and complex decision-making process, and a lack of a single, coordinated management structure.

Although Smith Barney recommends that the UEE ultimately become a true business enterprise in the private sector, it opposes UEE's immediate conversion to a private corporation. Because of the UEE's current organizational structure, unknown contingent liabilities, the lack of clear regulatory requirements for existing and new technology, uncertainties about the current spot market, and the lack of a commercial track record, its immediate privatization would result in a significantly less-than-optimal value to the Treasury, both in its sale price and annual cash flow.

To improve the UEE's competitiveness, the report recommends transferring the UEE to a newly-created government corporation, which can then be sold to the private sector to maximize the government's investment. To accomplish this objective, the new corporation must have "...an organizational structure and other corporate attributes as close as possible to those of a private corporation. In addition, it is imperative that the corporation be free of those administrative and financial controls that constrain the operational efficiency and financial flexibility of a government agency." This should include: moving the corporation outside the appropriations process and Gramm-Rudman-Hollings sequestration control; granting it authority to establish prices for commercial products, materials and services as the new UEE deems appropriate for maximization of profits; and providing it the responsibility for capital financing of improvements, including future spending on development and deployment of AVLIS.

Smith Barney argues that the AVLIS technology can be a significant factor in the new UEE's ability to reduce production costs for enriched uranium and to be competitive in the spot market. However, Smith Barney is concerned that the AVLIS technology may not be deployed in time to achieve its potential and, for this reason, it recommends that AVLIS development, deployment, and licensing be accelerated as much as possible. Smith Barney also recommends that the new UEE bear all further costs it incurs in preparing AVLIS for production.

The report concludes with a response to the question of whether this new UEE, and subsequently the new private UEE, should be directly responsible for the repayment of *sunk costs*. Those sunk costs are defined as "the liabilities for environmental clean-up and ongoing compliance, the costs of decommissioning and decontaminating facilities, and the settlement costs on contracts with the Tennessee Valley Authority." Smith Barney adds, "Efforts to directly recover all or a significant portion of these 'sunk costs' from the UEE's revenues, together with the proposed payback of 'unrecovered government costs' are misdirected and ill-conceived in the context of historical objectives and future business requirements. A requirement to recover these costs would merely serve to create a debt burden and contingent liabilities that will make ongoing enrichment operations infeasible..." The report suggests that the prime method to recover all, or part, of the sunk costs is to develop a competitive, profitable corporation, and then direct the profits received by the government towards reimbursement of those costs.

After a briefing on the report, congressional staffers expressed disappointment that, because the report is considered proprietary information, they are unable to hold hearings to discuss its conclusions. (DOE issued an edited version of the report on June 6.) However, House staffers indicated that the hearing calendar is full for the foreseeable future, and, since the report did not contain any startling new conclusions, there is no pressing need to consider this issue this year. In fact, with much of the summer devoted to clean air legislation, the budget and the appropriations process, it is unlikely a bill will move through the House in 1990, a congressional election year. □

CANADA

Canada Modifies Nuclear Export Policies

On May 18, 1990, the Canadian Ministry of Energy, Mines and Resources published the results of a Ministerial review, which began last summer, of the commercial aspects of Canada's uranium export policy. The review, part of an effort by the Canadian government to simplify the regulations, led to revisions which will clarify the terms under which Canada exports uranium.

Further-Processing (Upgrading) Requirements

The Ministerial review clarified the export policy by stating, "Canadian uranium destined for use as enriched uranium fuel shall be upgraded to the maximum extent possible in Canada before export, as long as Canada's conversion facilities have the capacity. Exemptions to this requirement will be granted in cases where:

- ◆ The uranium will be converted or enriched or consumed in the United States, or
- ◆ The Canadian converter is not the successful bidder for conversion services as a result of purely commercial considerations."

The previous policy's wording had been interpreted to allow the exemption of US-bound uranium from Canadian upgrading restrictions only if it were considered US product under the Free-Trade Agreement (FTA). To become US product under the FTA, US services needed to contribute at least 50 percent of the value added. Conversion represents only about five to ten percent of the value of natural UF₆, so the old policy seemed to require conversion and enrichment in the USA to gain the exemption.

Pricing Requirements

The pricing policy has been revised to read, "The Canadian government will expect pricing terms in export contracts to provide for an equitable balance of benefits and risks, and to be generally not less favorable than those being obtained in the same time period by competing Canadian and international producers for contracts of similar duration." Moreover, "...each export contract should include mechanisms, such as escalating floor price provisions..." These changes were made to "...help to reduce the impact of unexpected shifts in the market and thereby contribute to a more predictable commercial environment..."

Domestic Security of Supply

Canada's Uranium Exports Review Panel, under the ministers' authorization, will now approve uranium export contracts extending for up to thirty (30) years from the contract execution date as opposed to fifteen (15) years under the previous policy. Also, "It will no longer be required that individual Canadian utilities demonstrate that they have uranium purchase contracts in place to cover their uranium requirements for a specific period of time." Both changes are attributable to the recent estimates that Canadian reserves far exceed the total of domestic requirements plus export commitments. ■

RECENT DEVELOPMENTS

WASHINGTON FOCUS

May was a busy month in Washington. The House of Representatives passed the Clean Air Amendments Act, DOE released an executive summary of the report by Smith Barney on DOE's uranium enrichment enterprise, and DOE acknowledged it is considering a purchase of Soviet SWU to offset part of its production. In addition, the Nuclear Power Assembly's conference, *Nuclear Energy & The Nineties: The Decade for Progress*, was held at the end of May. A common theme among the speakers was that public acceptance of nuclear power will be the key to any new plant orders.

Clean Air Act

◇ On May 23 the House of Representatives passed the Clean Air Act Amendments bill by a vote of 401 to 21. A joint House and Senate conference committee will meet this summer to negotiate the remaining compromises necessary to pass a law for the President to sign. Many of the outstanding issues affect the utility industry; however, two issues directly affect the nuclear fuel industry. First is a resolution of the dual regulation issue (NRC or EPA) for radionuclides, which is included in the Senate bill, but not in the House version. It should be noted the EPA has not yet completed its rulemaking on radionuclide emission standards, and it is unclear whether the EPA will wait until the legislative process has concluded before proceeding.

The second issue directly affects the three plants, operated by Electric Energy Incorporated (EEInc.) and Ohio Valley Electric Corporation (OVEC), which supply power to DOE's uranium enrichment plants. The plants' emission allowances and their schedule for compliance with the stricter standards of the House bill would significantly increase DOE's costs, and at an earlier date than the Senate bill. The House bill prohibits EEInc. and OVEC from trading any credits they might earn from reducing their plants' emissions; thus, DOE, and therefore its customers, would bear the entire cost of the emissions cleanup.

DOE Uranium Enrichment Funds Reallocation

◇ DOE's request for authorization to reprogram \$20 million of the uranium enrichment program's surplus funds for FY90 to unrelated programs (Savannah River reactor startup, advanced reactor design certification, and space research) has stirred controversy in Congress. The American Nuclear Energy Council (ANEC) and the Edison Electric Institute (EEI) jointly wrote a letter objecting to DOE's request to reallocate the funds. They described the request as another example of how DOE's other priorities prevent the enrichment program from being competitive, and as a good reason to enact privatization legislation in order to remove it from government control. Several Congressmen also expressed their opposition. The appropriations committees will consider DOE's request within the next month.

RECENT DEVELOPMENTS**DOE Purchase of
Soviet SWU Possible**

◇ Secretary of Energy James D. Watkins confirmed that DOE has discussed with the Soviet Ministry of Atomic Energy & Industry the possibility of purchasing Soviet SWU. Some discussion of US-origin uranium as feed for this contract is also taking place. Such a sale, if made, might carry certain restrictions, such as a cessation of direct sales of Soviet SWU to US utilities. The Soviet Union has also offered to use the foreign currency earned from this DOE sale to purchase goods and services in the USA.

If DOE purchases Soviet SWU to lower its production costs, will it pass this savings on to its customers in lower SWU prices, or will the government keep the savings? That will be one key issue. Another will be finding a mechanism to prevent diverted Soviet SWU from entering the US market. Finally, Congress will insist that DOE can only purchase SWU if the price is lower than DOE's production costs. If DOE must divulge to Congress its actual marginal cost of production, then US utilities, armed with this knowledge, may have new ammunition in their discussions with DOE about termination charges. Secretary Watkins has indicated he would not consider any deal that would jeopardize the department's push for legislation to privatize the program, stating, "If it's a serious political obstacle, I'm not going to do it."

**Nuclear Power Assembly
Conference**

◇ On May 21-23 the Nuclear Power Assembly held a conference entitled *Nuclear Energy & The Nineties: The Decade for Progress*. The most prominent group of speakers assembled at this conference in recent years attracted over 350 people to Washington, DC. Among the speakers were Secretary of Energy James D. Watkins, former Secretary of Energy James R. Schlesinger, a number of administration officials, and several congressmen. The conference focused specifically on advanced reactors; topics ranged from legislative and regulatory initiatives to promote them, to the actual designs and conditions necessary to stimulate orders.

One conclusion to be drawn from the conference was stated succinctly by former Virginia Governor Gerald L. Baliles who believes that, "In the 1990s, improvements in the economics of nuclear energy, combined with growing concerns over the environmental costs of non-nuclear power, could help build greater public acceptance." Many of the speakers indicated that nuclear energy will only be considered as a viable option when the public recognizes the need for it, and when the nuclear waste issue is solved with the construction of a spent fuel repository. Some speakers thought that an actual energy shortage may be necessary before public sentiment will change.

A consensus has formed on the next steps to be taken to create an environment conducive to a new nuclear plant order. First, utilities need standardized designs with inherent safety features that are preapproved by the NRC. Second, there is a need to restore the regulatory compact between

RECENT DEVELOPMENTS

**Radiation Victim
Compensation Act**

utilities and public utility commissions to ensure that approval for new plant orders will not be disallowed, and to simplify the current regulatory structure (one speaker referred to it as a byzantine horror show). Third, the USA must solve the practical problems of spent fuel disposal. Finally, the industry must establish better communication practices to alleviate public concerns.

The main obstacle to new nuclear plant orders is the stalled high-level waste repository program. Secretary Watkins and several other speakers mentioned the possibility of recycling some of the uranium and plutonium from spent fuel and burning the long-lived actinides in a new reactor design, the Integral Fast Reactor (IFR), which is under development in Idaho. Although this solution would significantly reduce the volume of waste and also reduce the length of time (from thousands of years to only a few hundred) over which the waste would need to be monitored, it does not obviate the need for a repository.

◇ The House of Representatives passed by voice vote the "Radiation Victim Compensation Act" (HR 2372). The bill is designed to compensate uranium miners in Arizona, Utah, New Mexico, and Colorado who were associated with the government's defense programs, and also civilians, known as "downwinders", who lived near the Nevada Test Site. The Senate Judiciary Committee is considering a similar bill, which includes Wyoming's uranium miners. If enacted, the bill will establish a precedent for the federal government to assume responsibility for the consequences of past defense nuclear activities, and could lead to creation of a fund compensating uranium mining companies for mill tailings cleanup. ■

INDUSTRY BRIEFS

Chernobyl Closure Announced

Coinciding with the fourth anniversary of the Chernobyl-4 accident, five members of the Supreme Soviet made a surprise announcement at a joint news conference in Washington D.C. that the three remaining operational RMBK reactors at the Chernobyl site would be shut down by the end of 1991. New disclosures on the magnitude of severe health effects caused by Chernobyl, as well as safety concerns about the entire plant led to the decision. The Ukrainian government requested the closures, although they will cost the Ukraine region nearly one-tenth of its electrical supply.

♦ ♦ ♦

Pakistan Reopens Baghalchar Uranium Mine

Pakistan's only uranium mine, Baghalchar (located in the Dera Ghazi Khan district of the Punjab province) is being reopened. Early this year, it had been shut down following the deaths of two employees in localized fighting.

Czechoslovakia Delays Temelin-1 and -2

Czechoslovakia announced that completion of the Temelin-1 and -2, 1,000 MWe VVER (Soviet PWRs) nuclear units will be delayed two years to 1994. The Soviet PWR designs will be backfit with Western safety technology. Temelin-3 and -4, which were already under construction, have been cancelled. Czechoslovakia's demand for electricity is expected to rise over the next decade and nuclear power is considered the best solution for added generating capacity. International bids will be sought for the next 1,000-MWe units, on the condition that Czechoslovakian industries supply a major portion of the equipment.

♦ ♦ ♦

QML To Sell Stockpile

Queensland Mines Ltd. (QML) has reached an agreement to sell its 6.5 million pound uranium inventory and associated sales contracts to a European intermediary.

Cameco Locates Major Deposit At McArthur River

Cameco announced on May 30 that further drilling at McArthur River P2 North has confirmed expectations of a large, high-grade uranium deposit. Cameco believes that the reserves will exceed 100 million pounds at an average grade of over three percent U₃O₈. Cameco is operator of the McArthur River Joint Venture, which includes Cameco, Uranerz Exploration and Mining Ltd., AGIP Resources Ltd., Interuranium Canada Ltd., Cogema Canada Ltd., and Imperial Metals Corporation. Timing of mine development will depend on the world uranium market and other considerations such as nearby mill capacity.

♦ ♦ ♦

South Africa Likely To Sign NPT

South Africa is expected to sign the nuclear Nonproliferation Treaty (NPT) soon, as indicated by South Africa's closure of its pilot enrichment plant. US officials hope South Africa will formally announce its intention to adhere to the NPT before the NPT review conference in Geneva later this summer.

RECENT DEVELOPMENTS

**EdF Seeks Approval To
Build Seven New Plants**

EdF plans to build seven 1,400-MWe nuclear power plants, and will begin construction of one a year starting in 1993. Only a year ago, just four new plants were expected to be needed by 2000. Increasing electricity sales, strong economic growth in France, and a number of long-term, electricity export contracts contributed to the change in plans. The Ministry of Industry supports EdF's request, and will seek approval for project funding from the French government.

♦ ♦ ♦

**New Orleans Public
Service Sale Tabled**

The city of New Orleans' purchase of the New Orleans Public Service Inc. (NOPSI), originally proposed to shield taxpayers from the cost overruns at Grand Gulf-1, has been tabled by the city council on the basis that the potential savings were not worth the financial risks. The highly publicized deal had already been agreed to following a \$10 million, seven-year study that estimated a possible one billion dollar savings to the city.

**Operating License Issued
For Melox Plant**

On May 21, the French government issued an operating license for the Melox mixed-oxide (MOX) fuel fabrication plant. Located at Marcoule, the plant has been under construction since early 1989 and should be completed by early 1994. It will have an annual capacity of 120 metric tons of heavy metal (MTHM), though the license currently limits it to about 100 MTHM/year. The US\$250 million Melox plant will process into MOX fuel assemblies much of the plutonium from the La Hague reprocessing plant.

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**NRC To Announce Proposed
Rule For Extending Plant
Licenses for 20 Years**

The Nuclear Regulatory Commission (NRC) intends to publish in the *Federal Register* on June 29 a proposed rule allowing plant licenses to be extended for 20 years. A final rule is planned for publication in May 1991. One of the NRC's main problems is whether these plants should be required to comply with safety standards for new plants.

**Swiss Nuclear Utilities Plan
To Increase Unit Capacities**

As a result of public opposition to a sixth nuclear power plant in Switzerland, Swiss utilities are seeking alternative methods for increasing their generating capacity. The utilities are now planning to increase unit capacities by 7% to 15%, adding as much as 200 MWe to the national grid by the middle of this decade. All the modifications can be made without compromising Swiss safety standards, but will require relicensing of the plants. The public will have the opportunity to comment on the proposals for capacity increases.

♦ ♦ ♦

**Vandellos 1
Permanently Closed**

The Spanish government has announced the permanent closure of the Vandellos 1 nuclear unit, shut down last October following a fire. The decision, based on the excessive costs of plant repair and modernization, may adversely affect the future of Spain's nuclear program.

FINANCING URANIUM EXPLORATION AND DEVELOPMENT PROJECTS IN THE 1990s

The following article is an edited version of a speech presented by NUEXCO's Dustin J. Garrow at the 92nd Annual General Meeting of the Canadian Institute of Mining and Metallurgy in Ottawa, Canada on May 8, 1990.

Introduction

The uranium production industry experienced momentous change during the decade of the 1980s. The Three Mile Island accident took place in the spring of 1979 and, while not necessarily creating the uranium "bust" of the ensuing decade, certainly set the tone for the entire nuclear power industry.

Ever-increasing forecasts of installed commercial nuclear power coupled with a growing concern regarding the adequacy of uranium reserves and production capacity, ignited a wave of exploration and production capacity development in the mid-to-late 1970s which continued into the early 1980s. This momentum led to over-production of uranium concentrates when compared to the eventual operation of commercial nuclear power plants. This material resulted in expanding inventories held by uranium producers and consumers alike. As these stockpiles inevitably found their way into the spot market, the price (as indicated by the NUEXCO Exchange Value) fell from a peak of \$43.40 per pound U₃O₈ in May 1978 to its current level of \$8.80 per pound U₃O₈ on April 30, 1990.

As the nuclear power industry enters the 1990s, the debate regarding global warming and the subsequent role of nuclear power generation take on more importance. In any event, the nuclear power programs initiated principally in the 1970s are nearing completion. Even though new orders of power reactors have dropped precipitously in the 1980s, the generation of electricity by nuclear fission accounts for almost twenty percent of WOCA (World Outside Centrally Planned Economies) electricity production.

In order to place my main topic of financing future uranium exploration projects in perspective, I will review the conclusions of a uranium market study recently

completed by NUEXCO Information Services, a group which closely monitors and evaluates the nuclear power industry and the nuclear fuel cycle.

The International Uranium Market

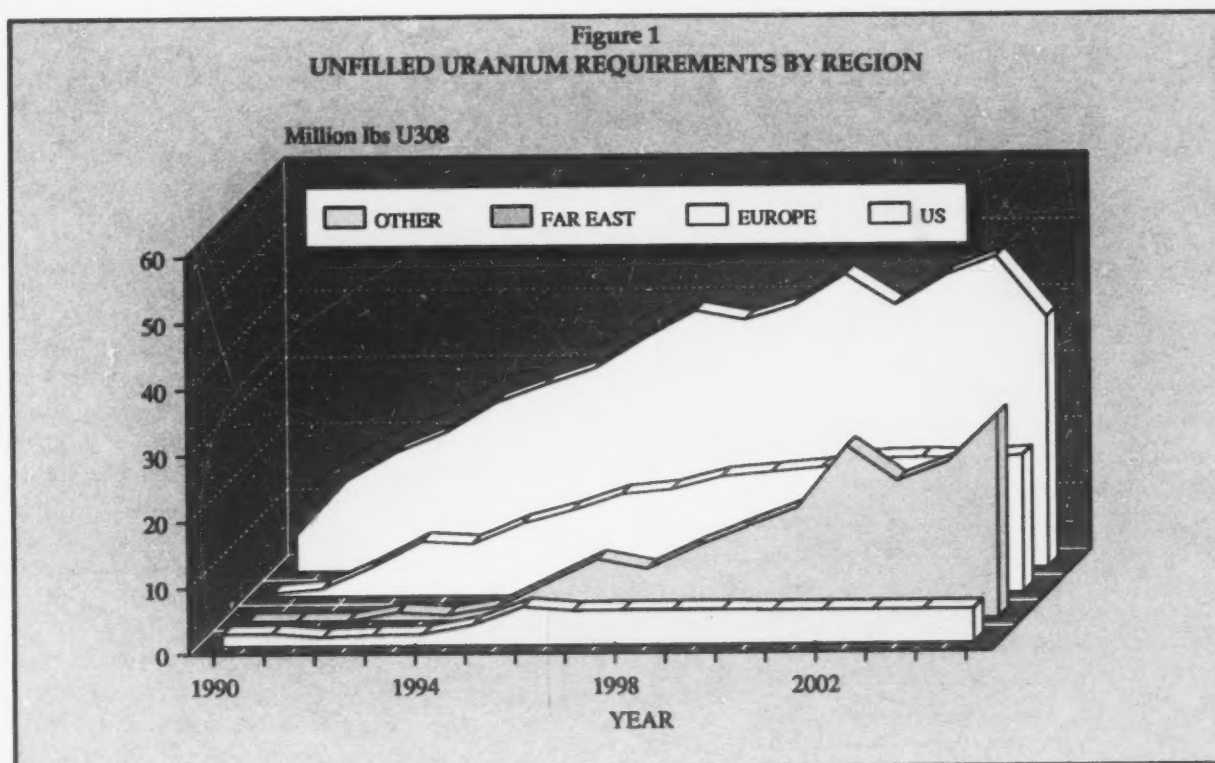
The commercial, non-military uses of natural uranium concentrates consist of fuel for nuclear power reactors. Therefore, the demand for the commodity is a direct function of the level of installed nuclear generating capacity.

At the end of 1989, the total WOCA installed nuclear generating capacity stood at 262,000 MWe (megawatts electric). Under NUEXCO's reference growth case, that total is expected to grow to approximately 336,000 MWe by the year 2000, a compound annual growth rate of approximately 2.1 percent. However, it should be recognized that nuclear power growth will not be evenly distributed. It is anticipated that the USA will experience the lowest annual growth rate (0.7 percent) while the Far East will expand at a much higher rate (5.1 percent per year). Western Europe should increase at 1.7 percent per year, a rate slightly below the WOCA average. These growth rates reflect the relative maturity of the various nuclear power programs and the continuing support for nuclear power among Asian countries.

Uranium requirements from this growth in generating capacity will require a total of 1.6 billion pounds U₃O₈ over the period 1989-2000. This total will, of course, be influenced by a number of factors such as the capacity factor of the reactors themselves, as well as various factors unique to the nuclear fuel cycle. By the year 2000, Western Europe will be the most significant consumer of uranium, representing more than 40 percent of the total; while the United States will require almost 30 percent of the aggregate WOCA need. Utilities in the Far East will consume about 23 percent of the total.

Although the aggregate annual uranium requirement is of substantial importance, the amount of uranium yet to be contracted for is the crucial element for uranium exploration and the development of new production facilities. Historically, utilities with massive investments

ANALYSIS AND COMMENTARY



in nuclear power stations have relied upon long-term uranium supply agreements to provide the degree of reliability determined to be necessary to ensure uninterrupted plant operations. Although this strategy has undergone some changes in recent years, according to NUEXCO's extensive data base of uranium contracts, WOCA utilities had committed to purchase fully 60 percent of the forecast uranium requirements through the year 2005. However, once again, that coverage was unevenly spread throughout the various consuming countries. While European countries' existing long-term purchase agreements could provide more than 75 percent of anticipated uranium needs and Far Eastern utilities have as much as 65 percent of requirements already committed, the US nuclear utilities have only covered one-third of their requirements over the next decade and a half.

Based upon this assessment, unfilled WOCA uranium requirements over the period 1989-2005 total just under one billion pounds U₃O₈. American utilities will need to procure almost 500 million pounds U₃O₈ in order to satisfy reactor feed requirements during that time frame

(Figure 1). NUEXCO has conducted a detailed evaluation of each specific uranium production facility in the Western World. Such factors as reserve base, ore grades, extraction technology, future delivery commitments, and production costs are assessed and a judgement made as to the future role of that specific facility in the 1990s and beyond. Those collective judgements are then aggregated to develop the uranium production forecast. This forecast includes the emergence of the COMECON countries (principally China and the Soviet Union) as long-term sources of nuclear fuel for the Western utilities.

While China's future role appears to be defined by existing long-term delivery commitments to European and US utilities, the Soviet Union has begun to expand its marketing activities beyond supplying uranium enrichment services to Western Europe. It is NUEXCO's opinion that the Soviet Union can possibly supply as much as eight million pounds U₃O₈ per year to the West by the mid-1990s, compared to only three million pounds total contributed by all COMECON countries in 1989.

Taking into account uranium exports from China and the Soviet Union during the 1990s, NUEXCO anticipates that worldwide uranium production will still decline to 88 million pounds U_3O_8 in 1990 and continue that downward trend through 1992 when the total will fall to 84.7 million pounds U_3O_8 . Total uranium production will then commence a trend of gradual annual increases through the year 1999 when aggregate production will reach slightly more than 120 million pounds.

Uranium Price Trends

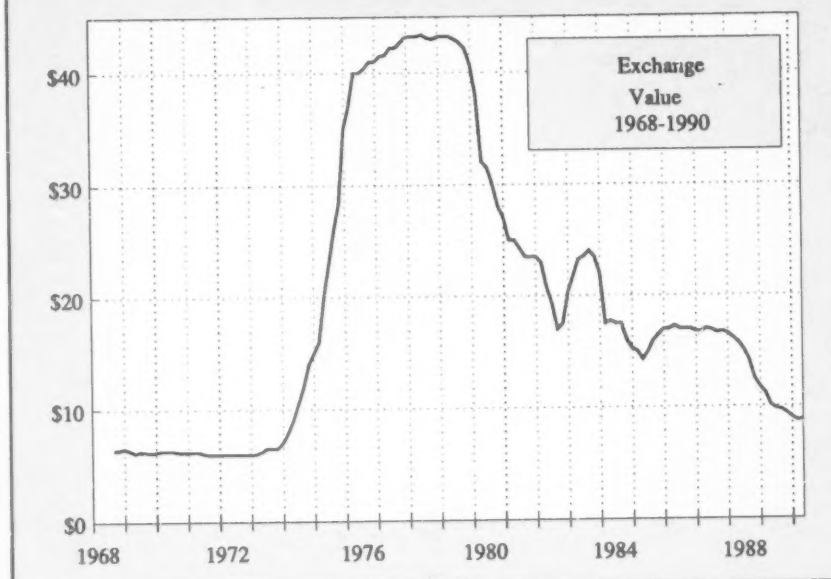
No discussion of a mineral commodity would be complete without some indication of price trends. NUEXCO's monthly uranium market price indicator, the NUEXCO Exchange Value, was first published in August 1968 at a level of \$6.35 per pound U_3O_8 . It has since risen to a zenith of \$43.40 per pound U_3O_8 in May 1978, and then declined to a record low, in constant dollars, of \$8.70 per Pound U_3O_8 on February 28, 1990. It was most recently reported at \$8.80 per pound U_3O_8 on April 30, 1990 (Figure 2).

Now, what about future uranium prices? Well, NUEXCO's current price forecast is considered proprietary and available only to subscribers to the Annual Uranium Market Study. However, I can state that uranium producers may expect improved contracting conditions over the next several years. This is not to say that "happy days" will be here again, but, market conditions should become more encouraging for the uranium production sector, with prices sufficient enough to encourage new development.

Uranium Exploration Activities

The International Atomic Energy Agency's (IAEA), biennial report entitled, "Uranium—Resources, Production and Demand," compiles worldwide uranium exploration

Figure 2
NUEXCO EXCHANGE VALUE
1968-1990



statistics. For those countries reporting, as of the end-of 1986, uranium exploration expenditures declined from more than US\$537 million in 1981 to \$150.3 million during 1986, a 72 percent drop. The most significant decline occurred in the USA where 1981 expenditures totaled \$180.3 million but plummeted to \$25.1 million a mere five years later.

In its assessment of uranium exploration, the IAEA makes the observation that:

"Although the current level of exploration may not be an immediate cause for concern, as known resources and inventories are adequate to provide the required uranium supplies for several years, it may not be sufficient to secure the resources needed for the longer term, which have to be located before long if they are to be developed in time for use at the beginning of the next century."

It is worthy of note that uranium exploration expenditures during 1985-1986 represented less than 15 percent of WOCA's peak expenditures of 1979-1980.

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Turning now to Canada specifically, market conditions have clearly resulted in a severe reduction of Canadian uranium exploration as well. Virtually all activity is being carried out in the Athabasca Basin of Saskatchewan and the Northwest Territories. Uranium exploration expenditures peaked in 1980 when more than 503 kilometers were drilled. During the period 1984-1986, exploration activities remained relatively stable and experienced a slight upturn in 1988. Corporate expenditures on advanced exploration programs at the Cigar Lake and Midwest Projects were major contributors to this gain. According to Energy, Mines and Resources Canada, the ten most active operators accounted for 98 percent of total expenditures.

Uranium Development Projects

As you will recall, NUEXCO's latest projection of uranium production indicates that uranium output will need to increase beginning in the mid-1990s. An examination of the specific production centers reveals that during the 1990s, NUEXCO anticipates that approximately 20 new uranium production facilities may be developed in order to satisfy growing uranium demand. These projects represent an annual production capacity of 42.6 million pounds U₃O₈.

Utilizing general "rules-of-thumb" for newly-constructed uranium production projects, the total capital required to put this capacity in-place could approach \$1.0 billion. That assumes that each conventional production center constructs its own processing plant, which might not be the case (particularly in

Saskatchewan), but, in any event, the infusion of capital into the uranium industry could be relatively significant.

According to NUEXCO's projection of new production facilities, more than 70 percent of that added capacity is expected to take place in North America. Western Canada is anticipated to be the leader in uranium project development with five projects representing annual production capability exceeding 24.0 million pounds U₃O₈ (almost 57 percent of the additions) (Table 1).

To describe current conditions in the US uranium production industry as dismal would probably be too generous. According to data gathered by the U.S.

Table 1
POSSIBLE FUTURE URANIUM PRODUCTION CENTERS
(Western Canada)

Project	Ownership	Annual Capacity (Thousand Pounds U ₃ O ₈)
<u>SASKATCHEWAN</u>		
Cigar Lake	Cameco Cogema (France) Idemitsu Kosan (Japan) Korea Electric Power	12,000
Midwest	Denison Bow Valley Uranerz (West Germany) PNC (Japan)	3,600
McClean Lake	Minatco Occidental Inco	2,000
Dawn Lake	Cameco Cogema PNC CEGB (U.K.) Korea Electric Power	3,000
<u>NORTHWEST TERRITORIES</u>		
Kiggavik	Urangesellschaft Canada (W. Germany) CEGB Daewoo (Korea)	3,500
TOTAL		24,100

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Department of Energy's (USDOE) Energy Information Administration (EIA), in 1977, a total of 146 firms conducted uranium exploration, 135 companies were involved in uranium mining, and 26 firms operated uranium milling facilities. By 1988, 26 companies were active in uranium exploration, 15 companies mined uranium, and only three mills were operating.

Perhaps of more importance to future development is the fact that the US uranium supply industry suffered cumulative net financial losses amounting to \$940 million during 1982-1988. Moreover, the net book value of assets classified as property, plant and equipment declined by 84 percent from its 1982 level of \$2.1 billion down to \$338 million seven years later. These dire financial results have taken place even in the face of concerted attempts to restructure the industry to enhance its profitability.

The EIA, in its conclusions to the assessment of the financial capability of the US uranium industry, makes the following observation:

"Investment activity is usually spurred by considerations of current or future profitability, by capacity constraints, or by projected changes in future demand. None of these elements, singly or collectively, augurs well for a significant inflow of investment funds into the domestic uranium mining and milling industry in the foreseeable future."

Recent papers and presentations by industry participants and analysts on the subject of financing uranium developments reach similar conclusions: The absence of long-term uranium sales agreements containing prices which provide some foundation for taking a new uranium project into development, as well as the present high inventory levels and low spot prices, severely hinder the likelihood of new exploration and development, though it is most definitely necessitated.

Successful Development Financing Examples

Prior to examining future financing options for uranium developments, it might be instructive to briefly look at some of the financing strategies utilized in the past. The USDOE/EIA in its assessment of the "viability" of the US uranium mining and milling industry discovered that, during the period 1982-1988, a "significant percentage of total funds were initially generated by the industry from its continuing operations (i.e., net income, depletion,

depreciation, amortization, deferred taxes and other funds)." Obviously, it may be preferable to fund uranium exploration and development from the financial results of previous development. Moreover, the restructuring which has taken place in the USA as reflected by the decline in asset values, "implies the use (loss) of equity to finance the continued existence of the industry."

Let's now look at several examples of financing techniques used during the past decade for uranium developments.

◆ The Ranger Mine (Northern Territories, Australia) was financed through advances from a group of Japanese utilities (A\$140 million) as well as a syndicated loan program (A\$250 million). The project had placed a significant portion of anticipated production under long-term contracts with floor prices greater than US\$30 per pound.

◆ Uranerz Exploration & Mining financed its one-third interest in the Key Lake Project development utilizing a loan (C\$120 million) provided by the Bank of Montreal, Toronto Dominion Bank, and Barclays Bank. Once again, UEM had acquired long-term uranium sales agreements with minimum price provisions. Moreover, the banks required completion guarantees from UEM's parent company.

◆ The massive Olympic Dam Project received its development financing via the participation of British Petroleum, a minority participant in the project. One stipulation of the participation agreement was that BP would contribute funds necessary to conduct the evaluation as well as provide the requisite project financing.

◆ Gulf Mineral Resources expended more than US\$400 million on the initial assessment and development of the huge Mt. Taylor Project (New Mexico). It is NUEXCO's understanding that these funds were provided by the parent company.

◆ On a somewhat smaller scale, Uranium Resources, Inc. funded the development of its Kingsville Dome Project (South Texas) through a complex loan arrangement with Elders Finance, Inc., a US subsidiary of Elders IXL of Australia. This credit facility was initially established at US\$20.3 million and incorporated stock warrants and other considerations. Recently, URI completed a public offering of units

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(common stock plus warrants) totaling \$4.5 million. The proceeds from this offering are intended to be utilized to fund the development of the Rosita Project (South Texas).

◆ The Highland Uranium Project (Wyoming) received initial funding from a private share placement. The proceeds from this sale were applied to property acquisition, permitting and engineering/design. The project developer, Everest Minerals Corporation, then sold a minority share of the project to a West German mining company, Interuran, in a transaction which generated sufficient capital to fund project construction. Once again, the project's baseload production was already under contract at prices well above the spot market.

Due Diligence

The financing of future uranium production facilities will depend upon, to a great extent, the outcome of the process commonly referred to as "due diligence." This is a truism no matter if the project sponsors approach a financial institution (e.g. commercial bank), sources of equity capital (e.g. private placements, public offerings), or potential joint

venture partners. In all cases, the project proponent will have to satisfy the source of capital that the project represents a combined risk profile which is acceptable to that source.

Traditionally, the due diligence process examines a broad spectrum of issues relating to the proposed project. These issues include reserve base, ore grades, proposed extraction/processing technology, governmental/regulatory environment, status of permits/licenses, engineering evaluation, projected production cost structure, managerial/professional staff, experience of the personnel involved, anticipated market conditions, and the level of projected production committed under multi-year sales agreements with minimum price protection.

Each type of funding source will assess each factor and weigh the risks involved. Clearly, there are ways to "lay-off" risk which the financial source deems excessive or unacceptable. Corporate/personal guarantees and the pledging of project/corporate assets (including sales agreements) are only two of these approaches. Some may conclude that most, if not all, proposed uranium production facilities would fail to pass this due diligence review process. Perhaps, this is correct. However, I think not.

Table 2
URANIUM PROJECT PHASE/FINANCING ALTERNATIVES MATRIX

	Grassroots Exploration	Advanced Exploration	Reserve Delineation	Project Development	Construction
Risk Capital	X	X	X	X	X
Internal Financing	X	X	X	X	X
Public Offering (debt/equity)	X	X	X	X	X
U ₃ O ₈ Loans/Sales			X	X	X
Sales Agreement "factoring"				X	X
Bank Financing				X	X
Joint Venture	X	X	X	X	X
Advance Sales of Product				X	X
Trading	X	X	X	X	X

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Future Financing Alternatives

In his presentation before the Uranium Institute's Supply and Demand Committee (September 5, 1989), my NUEXCO colleague, Mr. Don Nichols, discussed a variety of financing options which might be available to develop new uranium projects. A summary table contained in that paper provides an "alternatives matrix" for financing approaches (reproduced as **Table 2**).

As you will see, a number of financing alternatives are deemed appropriate for project development. Once again, however, the due diligence process may limit the application of some financing techniques, particularly in the short-run.

As can be seen on the alternatives matrix, funding options for grassroots exploration are limited and really can come from risk capital, internal financing and joint ventures. The latter approach has become increasingly prevalent as an approach to spreading the exploration risk among several parties. However, internal financing remains a popular technique.

As a proposed project reaches the development stage, increasing options are presented due to the, hopefully, decreased associated risk. By this stage in the project evolution, engineering/design work has been completed, the requisite permits/licenses received, pilot plant operations conducted to support the earlier forecasts of production costs and technology applicability, and sufficient sales commitments secured to mitigate excessive market risk, especially in the early years of commercial operations. What are some of these financing approaches?

◆ **The joint venture** has been extensively utilized in uranium projects, many of which were devised under tax provisions, especially in the USA. This structure allows the participants to fund a share of the joint-venture on a percentage basis which differs from the actual ownership share.

◆ **Traditional bank financing** (usually in the form of a project term loan) has been effectively utilized in the past. Major factors examined in the due diligence process might include proven reserve base, proven mining technology, proven operational capability (difficult to demonstrate for a first-time producer), a "responsible" entity requesting the loan, and a firm sales contract with a financially sound customer (sales

commitment should ensure net cash flow of 150-200% of the principal and interest payable during the loan term).

◆ **Uranium loans** can provide a vehicle for project financing. The would-be producer borrows uranium which is then sold in order to generate the capital necessary to finance project development. The loan can then be repaid from future production plus accrued interest (sometimes payable in-kind).

◆ Another strategy which might apply involves **advanced sale of product** or, more likely, the *factoring* of existing long-term uranium sales agreements. Generally, these agreements must incorporate "predictable" pricing either in the form of a base price subject to escalation or a firm floor price if the agreement contains spot market-type pricing. These two approaches have been used in the not too distant past, but have been increasingly difficult to pursue as the spot market has deteriorated.

◆ **Government investment** and/or debt underwriting provided the financing for a number of past uranium developments. Perhaps the most recent example of this concept was the establishment of Saskatchewan Mining Development Corporation in 1974 (subsequently merged in 1988 with Eldorado Nuclear Limited to create Cameco, A Canadian Mining and Energy Corporation). The Province of Saskatchewan advanced equity funds for uranium exploration and development as well as underwrote long-term debt offerings. Although this activity might not be considered a subsidy for the company, the financial backing certainly helped SMDC's uranium activities progress.

Cameco

Before closing, I would like to make a couple of observations regarding the crucial role that Canada is expected to play in the future of the uranium production industry. As stated previously, more than 70 percent of anticipated new uranium production capacity is expected in North America and the majority of those additions will take place in Western Canada. Cameco will play a significant part in that future growth since it controls more than 400 million pounds of low-cost uranium reserves in the Athabasca Basin. Cameco produced more than 13.5

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million pounds U₃O₈ in 1989 for its own account, representing 15 percent of WOCA uranium production.

While the current ownership of Cameco is vested in the Province of Saskatchewan (61.5 percent) and the federal government of Canada (38.5 percent), the merger agreement called for the two governmental entities to reduce their shareholdings by 30 percent within two years, 60 percent within four years, and 100 percent within seven years. Unfortunately, market conditions have not been conducive for that schedule. Upon its formation, Cameco negotiated a loan agreement totaling C\$650 million with a consortium of eleven banks. The proceeds from this loan package were utilized to repay promissory notes issued by Cameco at the time of the merger.

In an effort to lessen its debt load, Cameco announced on April 2, 1990, that agreement had been reached to sell a one-third interest in the Rabbit Lake uranium mining operation to Uranerz Exploration and Mining Limited, a wholly-owned subsidiary of Uranerzbergbau-GmbH (Bonn, Germany). The sale price was C\$160 million, which is to be used to retire debt.

Conclusion

The current uranium market remains one of excessive inventories and depressed price levels. The financing of uranium exploration and development is problematic when the due diligence process is applied. However, company ownership and individual properties continue to change hands as firms assess the future of the industry.

Assuming that price levels begin to show some improvement and in the face of increasing demand for the product, I am of the opinion that sufficient financial resources will be available to the industry, perhaps from a variety of sources. Those companies which have positioned themselves with low-cost reserves should be able to proceed with planned projects on a schedule closely tailored to the marketplace. ■

ELECTRICITÉ DE FRANCE

Electricité de France (EdF), under the leadership of Pierre Delaporte, has become one of the most progressive organizations in the nuclear power industry. In recent years, EdF has adopted a newly aggressive, innovative attitude toward international market opportunities.

With 52 operating units (net capacity 51,000 MWe), France's national utility is the world's largest nuclear generator. It is fast becoming the battery of Western Europe, having exported 42,000 GWh in 1989 alone, a figure that could double by 1995 as power demand grows throughout Europe. Furthermore, by using its substantial operating experience, EdF has successfully taken over the French drive to export power plants worldwide. In the nuclear fuel market, the utility has expanded its activities beyond purchasing, assumed greater control over its fuel cycle, and sought innovative ways to manage its inventories.

Electricity Source for Europe

At 75-percent nuclear, EdF has the highest percentage nuclear generation of any major electric utility in the world and the largest installed capacity. **Table 1** illustrates the evolution of EdF's production mix since 1970. Hydro and coal-generated power dominated French production until the late 1970s, when the first of 34 standardized 900-MWe PWRs came on line. The country's nuclear power program expanded dramatically during the 1980s, as capacity increased fivefold (**Figure 1**). Eight large PWRs are nearing completion at present and will add another 10,800 MWe of capacity by 1993.

The rapid growth of nuclear capacity has outstripped French electricity demand, and many of EdF's plants have been underutilized in recent years. The average capacity factor at French nuclear plants in 1989 was 64 percent. However, EdF's prospects for exploiting the overcapacity have improved due to the following developments.

◆ **Growth of French Industrial Demand** — Under the direction of Mrs. Colette Lewiner, Director of Business Development and Commercial Strategy, EdF has aggressively marketed power to major industrial consumers in an effort to baseload demand for the 1990s. One of the first and biggest incentive power contracts was concluded with Pechiney, the giant aluminum producer; other contracts have been signed with users in diverse industrial sectors. Several foreign companies, Exxon for example, have established or enlarged their businesses in France, apparently lured by the attractive electricity rates. EdF's president, P. Delaporte, has referred to such contracts with foreign companies as "domestic exports" (see sidebar on page 31).

◆ **Demand for Power in Neighboring Countries** — Several of France's neighbors have been eager buyers of EdF's electricity, notably Italy and the UK, whose own nuclear power programs have been curtailed. Since the 2,000-MWe Cross-Channel link between France and the UK entered service in 1986, the UK has become EdF's leading export customer (**Table 2**). Spain, which recently made the decision to close Vandellós 1 (480-MWe GCR) despite rapidly growing power demand, could become another big buyer of French electricity. Portugal recently agreed to buy approximately 300 MWe per year from EdF via a Spanish utility.

◆ **Opening of Eastern Europe** The opening of Eastern Europe, where power shortages and smog pose urgent problems, is already providing direct opportunities for EdF in countries such as Hungary. Other opportunities are expected following the reunification of Germany. West German utilities

Table 1
EdF PRODUCTION CAPACITY (MWe)

	1970	1973	1976	1979	1982	1985	1988	1989
Nuclear	1.4	2.4	2.3	7.5	22.7	36.9	50.8	50.9
Thermal	13.5	17.1	20.5	22.0	22.1	20.1	16.9	16.2
Hydro	14.2	15.0	17.0	17.9	19.8	20.5	22.7	22.7
Total	29.1	34.5	39.8	47.4	64.6	77.5	90.4	89.8

Source: Electricité de France

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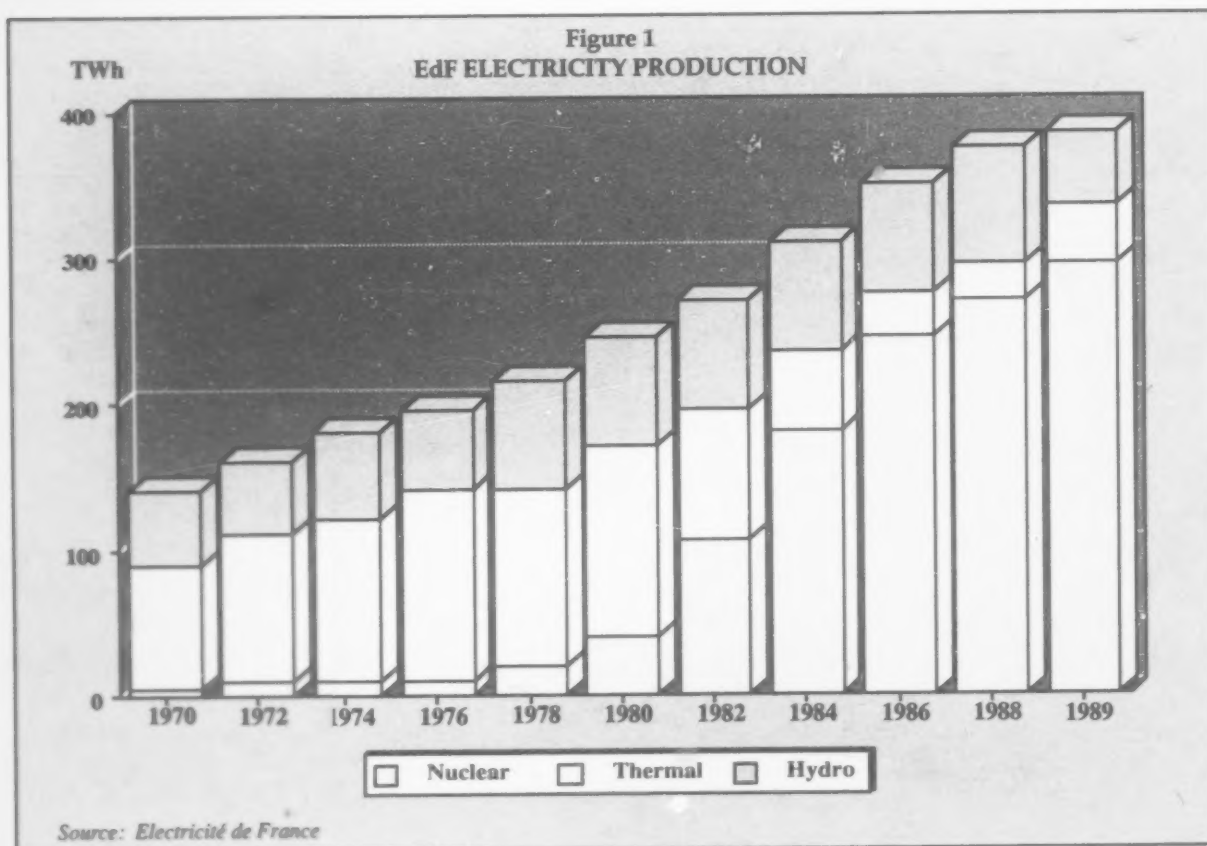
are likely to take over the East German market and closely influence the markets of nearby countries such as Poland and Czechoslovakia. Such an eastward shift will open new opportunities for EdF in West Germany, aided by the liberalization of the European Community market after 1992. Currently West Germany is not a major buyer of French electricity, mainly because coal-fired power is heavily subsidized in West Germany.

According to M. Delaporte, the main obstacle to the expansion of EdF's export sales will be the limited capacity of existing transmission lines. Environmentalists oppose erection of new high-voltage lines across the Alps, limiting EdF's direct access to Southern European markets. A new link across the English Channel would be more costly than the first, due to a much wider crossing. Access to Eastern European markets is dependent on construction of a modern power system in those countries, as well as power lines to reach them. Overcoming these obstacles presents a formidable challenge to European leaders, but

with the accelerating trend of European integration, the obstacles are not insurmountable. In any case, improvement of the European grid is probably more likely than construction of new nuclear capacity elsewhere in Europe.

Power Plant Expertise

In recent years EdF has successfully marketed its expertise in nuclear plant design and engineering, and has collaborated with Framatome, the French reactor vendor, to sell French power plants abroad. The state utility owns ten percent of Framatome; other owners are CGE (Compagnie Générale d'Electricité), a publicly traded company that recently gained a majority share in the vendor, and France's CEA (Commissariat à l'Energie Atomique). In an export market with few real opportunities, EdF has helped position the French nuclear industry for plant sales at Daya Bay in China, and



The following excerpts are taken from an interview with Pierre Delaporte, president of EdF, published in the French magazine, Le Nouvel Economiste, of April 20, 1990. The text is an unofficial translation from the French original.

On the possibility of additional plant orders in France:

"The only thing certain is the order for Civaux Unit 1. Aside from that, nothing has changed...although it is true that we at EdF are asking ourselves if we won't need to build a new unit every year, instead of one every two years as we thought a short while ago."

On electricity sales to industrial users in France:

"The deal with Pechiney was complemented by several smaller deals with companies in petrochemicals, chemicals, metallurgy, paper, etc. Our best exports have been domestic exports; i.e., sales to foreign companies operating within France. Factories have been built in France which, without our attractive power deals, would have gone elsewhere..."

On the growth of electricity exports:

"I think exports will grow, but they will also run up against an obstacle, which is the limited capacity of existing transmission lines and the difficulty in building new lines...For the UK, we need a second cross-channel link, but the structure of the British grid would force us to build the link far west of the first, with much longer sea length. The cost is estimated at one billion pounds sterling! With Italy, could we build a new line in reasonable time between the Rhone and the Po valleys, when we know how active the environmental opposition is on both sides of the Alps? The brakes on exports are no longer political...Today our biggest problems are environmental."

On electricity exports to Germany:

"We have been stopped, until recently, by the famous 'century contract' that forces German utilities to buy a large portion of German coal...Today we see the situation improving because of German reunification...[The East German production system] is worse than we thought, very old, inefficient, and ecologically disastrous...It will be better to burn West German coal in East Germany than to badly burn the lignite of the East. Suddenly the 'Siegfried Line' of electricity should go away like the Iron Curtain, and our power sales to Germany, until now rather weak, could rise to the level of our sales to the UK and Italy."

On power plants in Hungary:

"The Hungarians can go with us from hell to paradise. Switzerland enjoys an electricity paradise; strong national production, strong neighboring grid systems, therefore complete security...Hungary is comparable to Switzerland from the geographical point of view, but its electricity situation is the opposite... Hungary depends for 30 percent of its power supplies on the Soviet Union, a single faraway supplier. This is why EdF is studying the idea of building, through a joint venture or in another way, two 900-MWe units at Paks. The feasibility study will be completed at the end of this summer...The project would have major geopolitical significance, because there would no longer be just a few transmission lines, but a majestic bridge between East and West..."

On cooperation with Framatome for plant exports:

"We disagree [EdF and Framatome] about the idea of supplying power stations 'turnkey.' In the nuclear industry, we cannot, as is done in other industries, leave the site three months after the start of operation and forget about the plant...We have to have a long-term presence... Framatome can do that, maybe, but it is not a utility. The Chinese technicians for the Daya Bay plant are trained at Gravelines, and similarly, the Hungarians will not learn in the Framatome factories, but in EdF's plants."

On a nuclear power revival in the USA:

"Admiral Watkins [US Energy Secretary] talks seriously about a nuclear power revival in the USA after 1995. That could encourage others...However, we should not say that the Americans were right to stop their nuclear program in 1975 and are now right to restart it because the 'new nuclear' is better than the old, with all the business about 'inherent safety' and 'passive security'."

On cooperation with Germany:

"EdF feels that if we want to have a good nuclear industry in Europe, we have to ally ourselves with the Germans..."

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Table 2
FRENCH ELECTRICITY IMPORT/EXPORT NET BALANCE¹
1987-1989 (TWh)

	1987			1988			1989		
	Shared ²	Other ³	Total	Shared ²	Other ³	Total	Shared ²	Other ³	Total
Belgium/The Netherlands	- 1.4	2.9	1.5	- 0.8	3.9	3.1	- 1.3	4.9	3.6
Italy	0.3	4.8	5.1	0	9.6	9.6	0.6	10.8	11.4
Monaco	0	0.2	0.2	0	0.3	0.3	0	0.3	0.3
Spain/Portugal	- 0.8	2.3	1.5	- 0.8	2.0	1.2	- 0.6	0.1	- 0.5
Switzerland	3.2	3.8	7.0	3.7	3.3	7.0	4.0	8.7	12.7
United Kingdom	0	12.0	12.0	0	13.0	13.0	0	13.0	13.0
West Germany	2.6	0	2.6	2.7	0	2.7	2.3	- 0.6	1.7
Total	3.9	26.0	29.9	4.8	32.1	36.9	5.0	37.2	42.2

¹ Source: EdF

² Balance from cross-participation in power plants. (For example, France had a net import from Belgium and The Netherlands because of EdF's part ownership in Belgium's Tihange plant.)

³ Other means straight sales, purchases, or exchanges of electricity.

potentially in Hungary. China and Hungary are two of the few countries that are serious about building new nuclear plants at this time.

The Daya Bay project is modeled on EdF's Gravelines station in Northern France, where Chinese technicians also receive their training. The Hungarian contracts, signed in December 1989, initially involved engineering and consulting services for upgrading of the Paks station, but have evolved into a draft project for construction of two 900-MWe PWRs at the same site. The current plan is to dedicate one unit for Hungarian domestic consumption and one unit for electricity exports, mainly to Austria and Italy—two countries with nuclear moratoriums and substantial power needs. The power sales abroad would facilitate project financing.

EdF and Atomenergoexport (AEE), the Soviet Union's nuclear power plant export firm, signed a contract in December 1989 for France to provide plant expertise to the Soviets. Under the contract, EdF will install computer hardware and software for AEE for use in design work and will train the Soviet personnel in French facilities. The contract was signed by the utility's wholly-owned subsidiary, EdF International.

EdF has an active technical group working on the next generation of nuclear reactors, to succeed the current generation of 1,300-MWe and 1,450-MWe PWRs.

However, unlike research efforts in the USA, the French project, called "PWR 2000," is focused on improvements to the existing PWR design rather than fundamentally new reactor designs. EdF has never doubted the soundness of PWR technology. Although environmental pressure on the French utility has grown in recent years, both from the public and the government, it has not suffered criticism of its nuclear program to the degree that utilities in the USA and West Germany have been subjected.

Natural Uranium Activities

The recent announcement that EdF had entered negotiations to acquire Malapai Resources, a US uranium producer, signaled a change in the utility's approach to nuclear fuel procurement. EdF is clearly becoming more active and independent in the nuclear fuel market than in the past—just as it has become more active in nuclear plant construction and services. In plant exports, EdF has assumed a role traditionally held by Framatome. In uranium supply, it has entered the domain of Cogema (la Compagnie Générale des Matières Nucléaires), the CEA arm responsible for the nuclear fuel cycle.

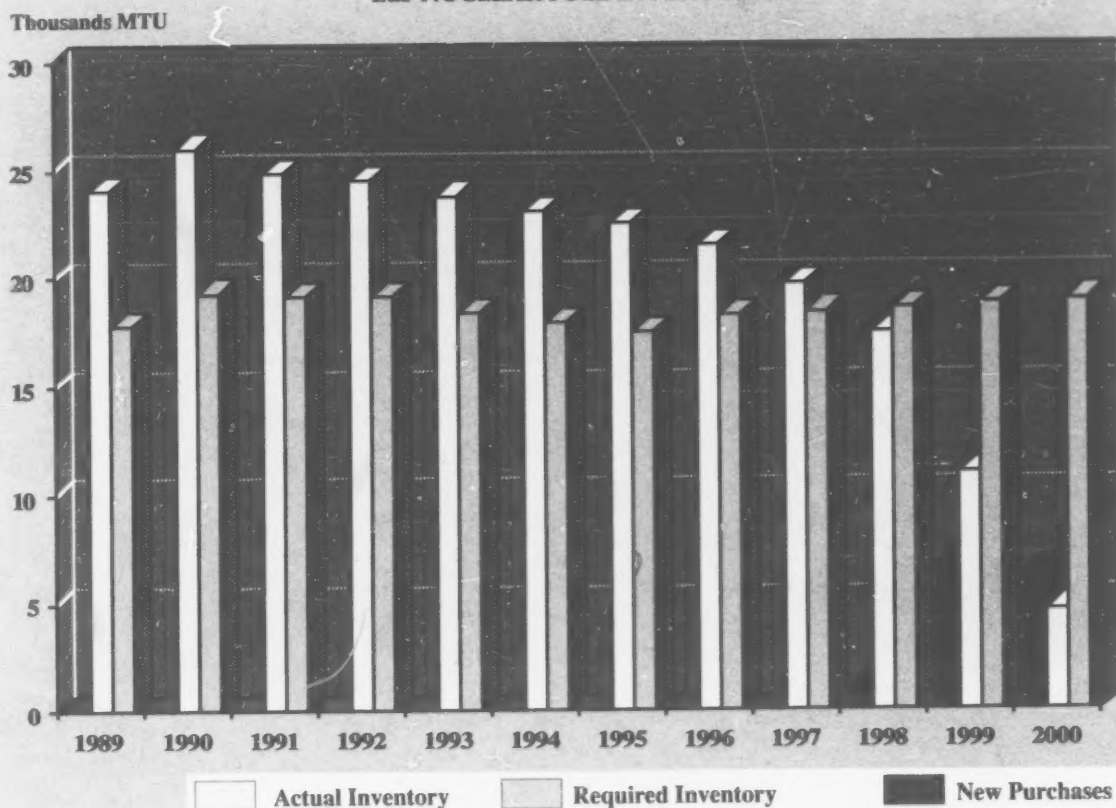
Historically, Cogema has supplied as much as 75 percent of the uranium EdF has purchased annually, while TOTAL,

Figure 2
FRANCE
NUCLEAR POWER UNITS AND FUEL CYCLE FACILITIES



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Figure 3
EdF NUCLEAR FUEL INVENTORIES¹



¹ Based on average expected requirements and existing supply arrangements as of August 1989.

Source: *The Nuclear Fuel Procurement Strategy of Electricité de France* by Yves Thomas, USCEA Conference, September 1989

the diversified French oil company, has supplied about 15 percent. Much of the uranium delivered by French suppliers has been produced from high-cost projects associated with French political interests. Some eight million pounds equivalent U₃O₈ per year comes from domestic production, subsidized for national security reasons. A similar quantity comes from Gabon and Niger, two underdeveloped African countries with close political ties to France dating from the colonial era. The other principal sources are Cogema's Canadian mining project at Cluff Lake, Saskatchewan, and TOTAL's interest in Rössing Uranium Limited, Namibia.

Cogema's two uranium supply contracts with EdF will continue for several more years, but despite increases in its installed generating capacity, EdF is not preparing to expand those arrangements. During the 1980s, EdF concluded a number of long-term contracts with suppliers outside France, as well as a handful of spot contracts to supplement its French contracts by about two million pounds equivalent U₃O₈ per year. Among those agreements were one with Queensland Mines Limited of Australia signed in 1981 and recently completed; one with ENU (Empresa Nacional de Uranio) of Portugal, signed in 1985 and nearing completion; one with CNEIC (China

Nuclear Energy Industry Corporation), signed in 1985 and continuing into the 1990s; one with ERA (Energy Resources of Australia) signed in 1988 and also extending into the 1990s; and one with Malapai, signed in 1986 and continuing for several more years.

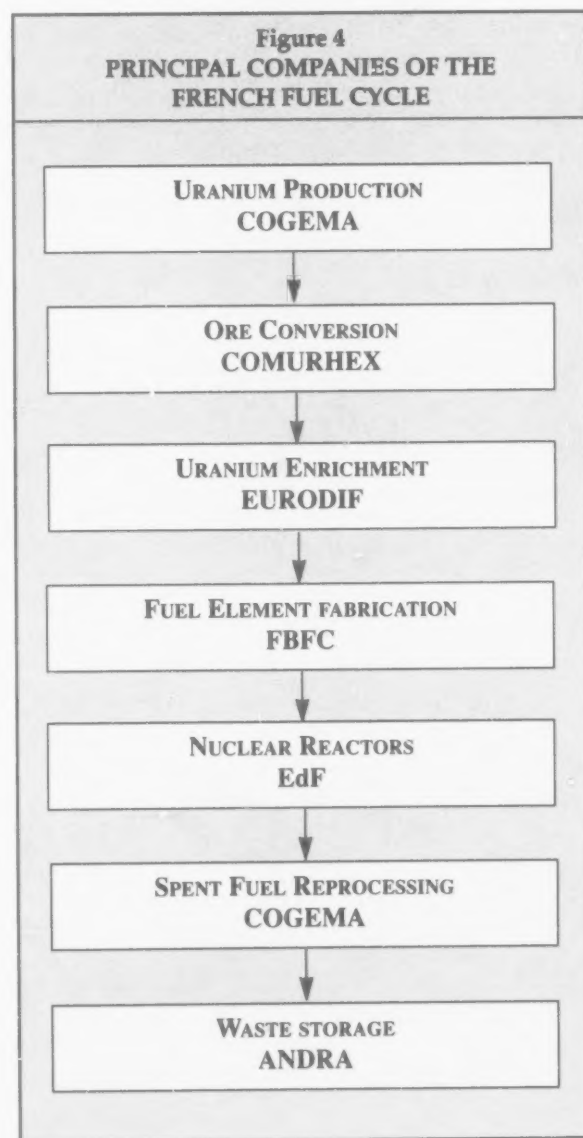
EdF's decision to acquire Malapai, a surprise move in a market that in recent years has seen little utility involvement in mining projects, could be viewed as an innovative strategy for inventory management, as well as an interest in long-term security of supply. Malapai's assets, in addition to its Wyoming uranium properties, include a handful of relatively high-priced contracts, among them, the one with EdF, one with Synatom of Belgium, and some in Japan. As the owner of Malapai, EdF could cancel deliveries to its own account and, in theory, service the Malapai contracts from existing supplies rather than costly new production. EdF's accumulated natural uranium inventory is estimated to amount to slightly less than four years forward requirements, a level that will decrease only slowly due to ongoing supplies received and technical fuel changes (Figure 3). The utility's minimum inventory requirement is three years' forward requirements, including concentrates, UF₆, enriched materials, and fuel assemblies.

The EdF-Malapai transaction is due to close on June 15, 1990, provided all technical conditions are met. The price has not been disclosed, although it is rumored to be in the broad range of US\$50 to \$60 million. EdF has created a US subsidiary, FITCO (Fuel International Trading Corporation), to handle its US uranium activities. TOTAL's US subsidiary, which has solution mining interests in Texas, would be employed as the operator of Malapai's uranium production business.

Fuel Cycle Activities

EdF's keen interest in fuel supply diversity and optimization may be motivated in part by its struggle to achieve a profitable balance sheet. In 1989 the utility lost approximately four billion French Francs on sales of FF146.7 billion. The 1989 loss was attributed mainly to warm weather conditions, which resulted in low hydro output, low cooling water levels at some nuclear stations, and increased coal and oil purchases. Other reasons for the loss included a government delay in implementation of rate increases, and technical problems at some nuclear plants.

Whatever the motivation, EdF is actively working to reduce its fuel cycle costs, potentially at the expense of its traditional French suppliers (Figure 4)—Cogema, Comurhex, Eurodif, and FBFC (Société Franco-Belge de Fabrication de Combustibles), all of whom depend on EdF for well over half their business. While the utility is unlikely soon to curtail its business with those suppliers, it may look elsewhere to cover new requirements.



FOCUS

Until now, EdF's only known conversion contract outside Comurhex has been held via Cogema, for Canadian concentrates at Cameco. However, the utility has not ruled out consideration of other lower-cost suppliers.

Similarly, EdF's relationship with Eurodif is evolving. The utility formally holds its enrichment contracts with Cogema, a 51-percent owner of Eurodif, but EdF no longer consults via Cogema for all arrangements with Eurodif. EdF directly negotiated a new arrangement with Eurodif for the early 1990s, under which it deferred substantial SWU deliveries and essentially brought its enrichment supplies into balance for the near term. Until now, the utility's only other known enrichment sources have been taken via Cogema, from both the US DOE and Techsnabexport, under long-term contracts entered into in the 1970s.

At the moment, EdF is bound by contract to reprocess some 8,000 MTU of irradiated fuel with Cogema. France's investment in reprocessing has been reaffirmed in recent years, and construction is underway on expanded reprocessing facilities at La Hague, reprocessed uranium reconversion facilities, and mixed-oxide (MOX) fuel

fabrication facilities. The utility has thus far supported these investments and begun a program to introduce MOX assemblies in the 900-MWe PWR series. A strategy for use of recovered uranium feed has not yet been defined; the decision in that regard is thought to rest on negotiations with enrichment suppliers, as well as with progress in the economic development of laser enrichment. In a paper presented in September 1989, Mr. Yves Thomas, head of EdF's Uranium-Enrichment Branch, noted that a decision on the use of recovered uranium should be made during 1990.

While EdF may have given no evidence yet of a shift toward new suppliers of fuel cycle services, nor of a decision to reconsider the economics of reprocessing, it has shown a clear interest in the secondary market as a vehicle to lower inventory carrying costs. Transactions such as loans, exchanges, and sale/buybacks have received considerable attention as a means of earning income and reducing costs. Such openness to new business reflects EdF's current spirit of enterprise. ■

Jim Lightner

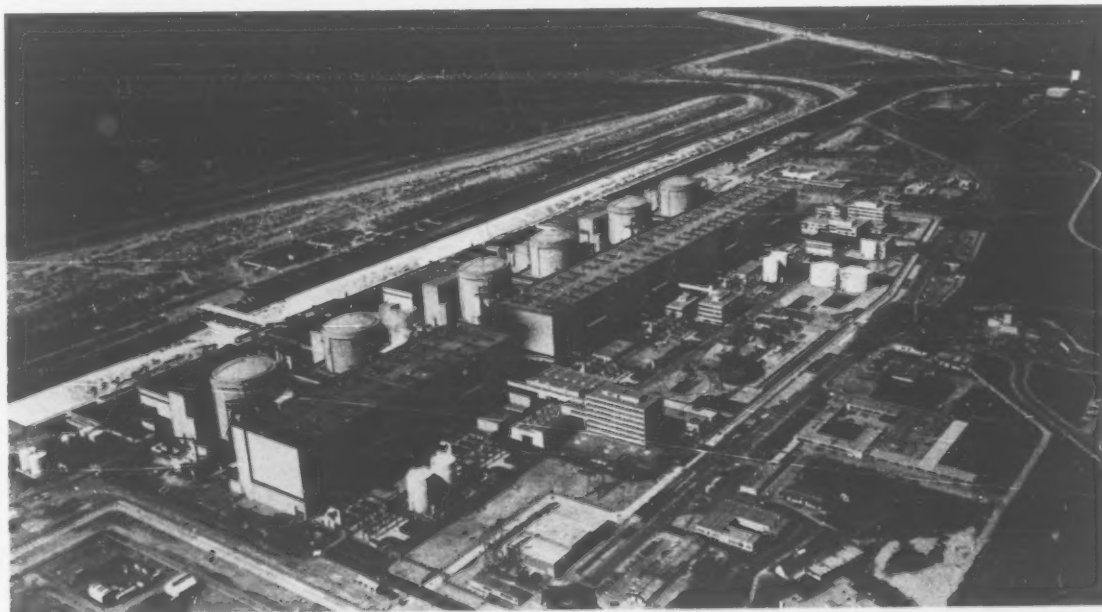


Figure 5. The Gravelines nuclear power station in Northern France, containing six 910-MWe net PWRs.

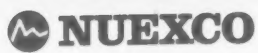
NUCLEAR INDUSTRY CALENDAR

1990

- June 10-15** *American Nuclear Society Annual Meeting* (Nashville, Tennessee). Contact American Nuclear Society at 1-708-352-6611.
- June 25-27** *Nuclear Power in A Changing World* (London, England). Contact British Nuclear Forum at telephone 071-828-0116, or facsimile 071-828-0110.
- Sept. 4-7** *International Seminar on the Costs and Financing of Nuclear Power in Developing Countries* (Jakarta, Indonesia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.
- Sept. 5-7** *Uranium Institute 15th Annual Symposium* (London, England). Contact the UI at 44-1-225-0308.
- Sept. 16-19** *Uranium Seminar '90* (Hyatt Regency, San Antonio, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.
- Sept. 23-26** *AMC Mining Convention* (New Orleans, Louisiana). Contact American Mining Congress, Suite 300, 1920 N Street N.W., Washington, D.C. 20036, or facsimile 1-202-861-7535.
- Sept. 23-28** *ENC '90 Congress & Exhibition* (Lyon, France) organized by the European Nuclear Society in collaboration with the ANS and Foratom. Contact Dr. P. Feuz, European Nuclear Society at 31-21 61 11.
- Oct. 14-16** *World Nuclear Fuel Market Annual Meeting* (Toulouse, France). Contact Donna Cason at 1-404-447-1144.
- Nov. 11-14** *Nuclear Energy Forum* (Washington Hilton, Washington, D.C.), sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611.

1991

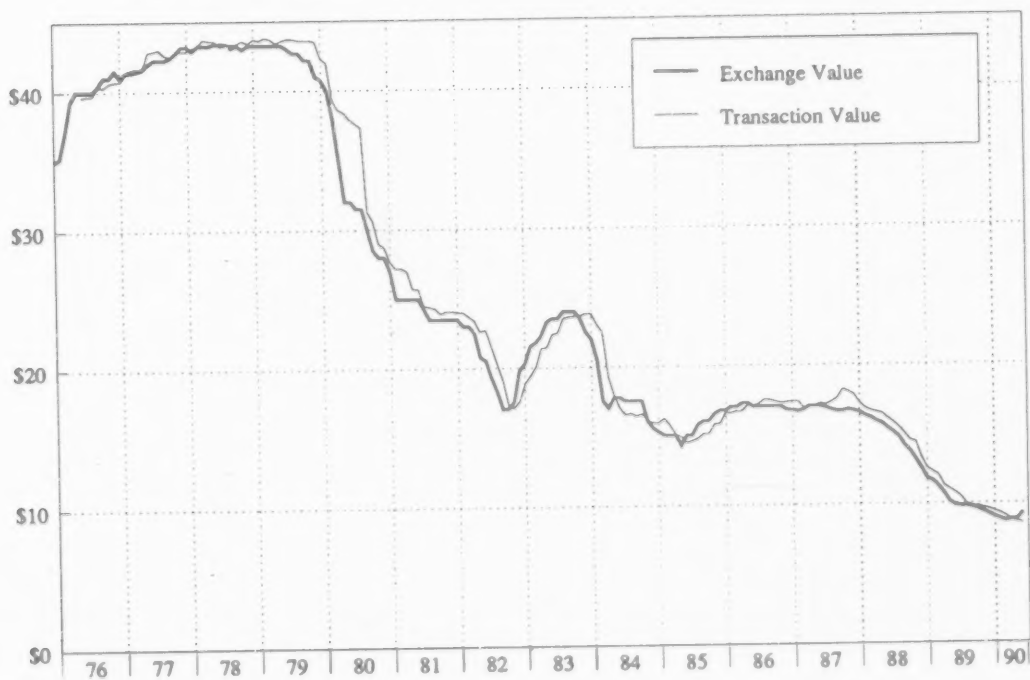
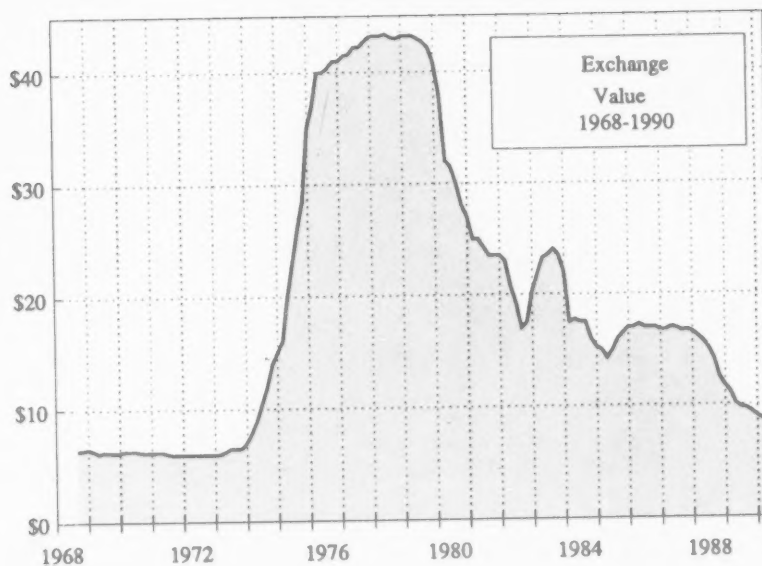
- April 14-18** *Third International Conference on Nuclear Fuel Reprocessing & Waste Management* (Sendai, Japan), sponsored by the Atomic Energy Society of Japan and the Japan Atomic Industrial Forum, co-sponsored by the American Nuclear Society and the European Nuclear Society. Contact the Japan Atomic Industrial Forum at telephone 3-508-2411, or facsimile 3-508-2094.
- May** *Second International Conference on Transportation for the Nuclear Industry* (Bournemouth, England). Contact the Conference Secretary, The Institution of Nuclear Engineers, at 081-698 1500.



HISTORICAL MARKET DATA

NUEXCO Historical Exchange Value and Transaction Value

(In US Dollars per Pound Equivalent U3O8)



HISTORICAL MARKET DATA

HISTORICAL MARKET VALUES

EXCHANGE VALUES

Determined as of the last day of the month indicated (\$US/lb U₃O₈)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85	8.70	8.80	8.80	9.25							

US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated (\$US/lb U₃O₈)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	Discontinued	



HISTORICAL MARKET DATA

UF6 VALUES

Determined as of the last day of the month indicated (\$US/kg U as UF6)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90	25.25	24.40	24.40	25.50							

US UF6 PREMIUM (Relative to the UF6 Value)

Determined as of the last day of the month indicated (\$US/kg U as UF6)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	Discontinued	

TRANSACTION VALUES

Determined as of the last day of the month indicated (\$US/lb U₃O₈)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25	9.05	8.75	8.65	8.55							

HISTORICAL MARKET DATA

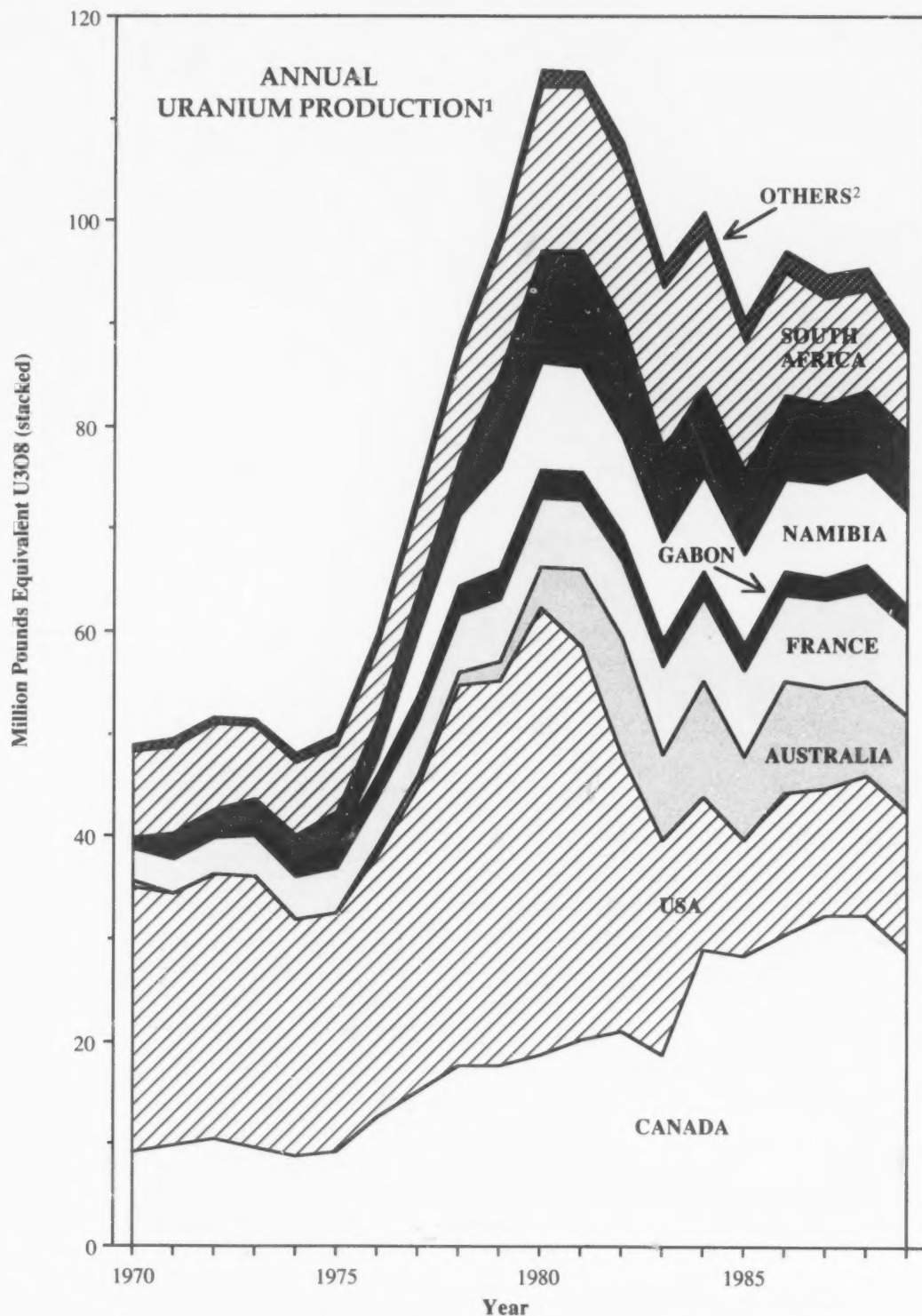
LOAN RATES												
Determined as of the last day of the month indicated (Percent per Annum)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50

* Float with Prime Rate

CONVERSION VALUES												
Determined as of the last day of the month indicated (\$US/lb U as UF6)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.50	1.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45

SWU VALUES												
Determined as of the last day of the month indicated (\$US per SWU)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54	50	50	50	50	50	50	50	50	50	50	50

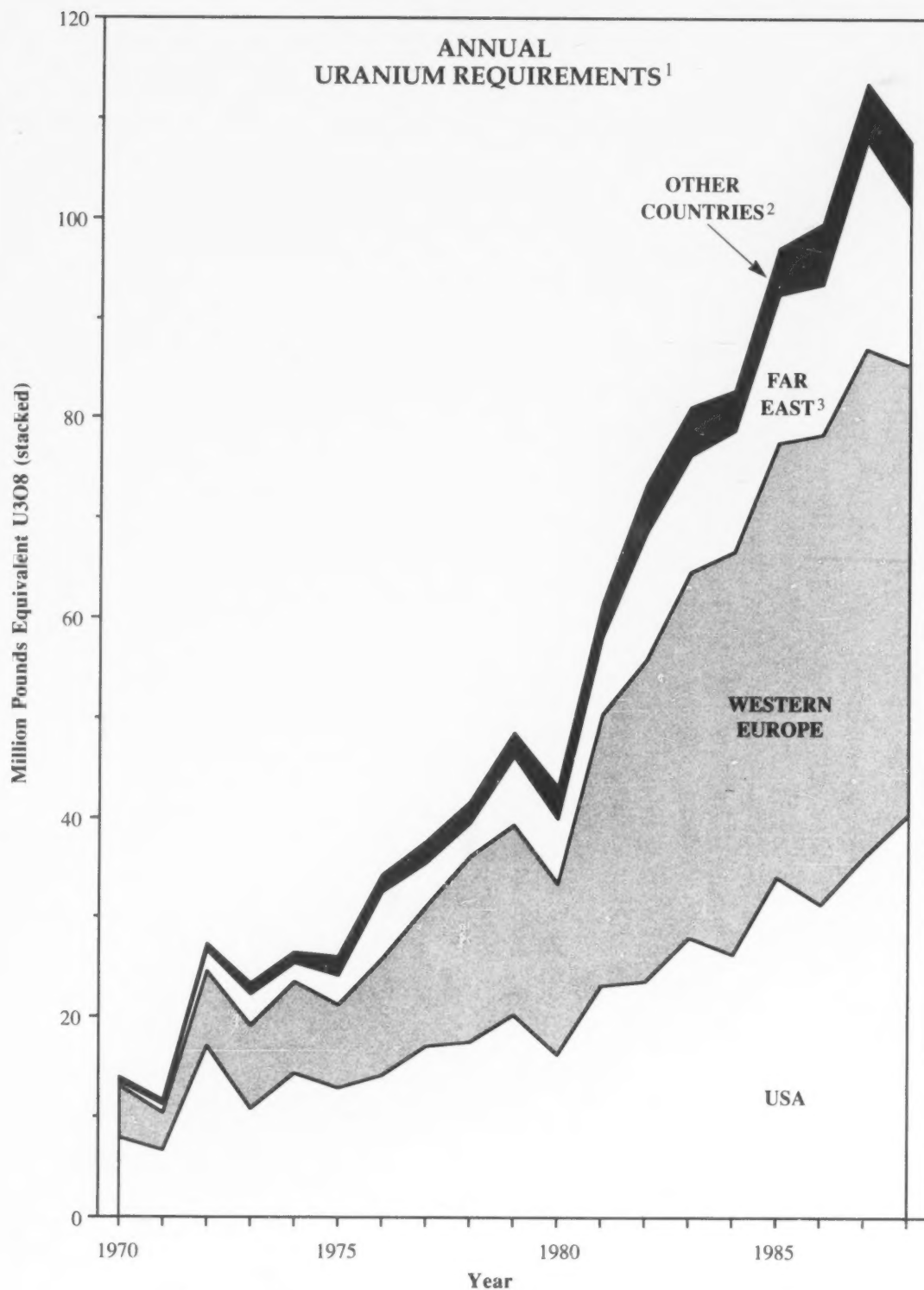
HISTORICAL MARKET DATA



¹ Estimated world production in 1989 totalled 89.6 million pounds (Australia—9.5; Canada—28.7; France—8.5; Gabon—2.2; Namibia—9.2; Niger—7.7; South Africa—7.7; USA—13.7; Others²—2.3).

² Others includes: Argentina, Belgium, Brazil, India, Pakistan, Portugal, Spain, West Germany and Yugoslavia

HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

² Other Countries include: Argentina, Brazil, Canada, India, Mexico, Pakistan and South Africa.

³ Does not include Peoples Republic of China.

GOVERNMENT STATISTICS

AUSTRALIA					
		Consumer Price Index ¹ (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ² (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia (Australian dollars) ⁶	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates ³ (June 1985=100)
1980	Avg.	95.8	83.1	—	140.8 ⁵
1981	Avg.	105.0	85.9	—	154.1 ⁵
1982	Avg.	116.7	89.0	—	174.9 ⁵
1983	Avg.	128.5	96.9	—	181.9 ⁵
1984	Avg.	133.6	98.0	—	194.4 ⁵
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
1989	Avg.	194.6	117.0	534.65	124.8
Jan	1989	—	110.6	—	122.2
Feb	1989	—	111.2	521.90	122.2
Mar	1989	188.0	114.9	—	123.1
Apr	1989	—	117.5	—	123.2
May	1989	—	118.6	530.40	123.7
June	1989	192.6	119.9	—	124.7
July	1989	—	120.1	—	126.2
Aug	1989	—	119.2	539.30	126.2
Sept	1989	197.0	117.7	—	126.3
Oct	1989	—	117.8	—	126.5
Nov	1989	—	118.0	547.00R	126.8
Dec	1989	200.7	118.2	—	126.8
Jan	1990	—	119.2	—	126.8
Feb	1990	—	120.8	—	127.2
Mar	1990	204.1	121.5	—	—

P = Preliminary R = Revised since last month

¹Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

²Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

³Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

⁴Monthly data for the period 1967 to 1986 appear in Report 233.

⁵Base: June 1976 = 100.

⁶Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

GOVERNMENT STATISTICS

CANADA								
Wage-earner Data: Average Hourly Earnings (C\$) ²								
		Industrial Products Price Index: All Commodities ¹ (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells ³ (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	138.2	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	143.8	20.91	18.51	16.95	13.17	13.77
1989	Avg.	131.0	151.0	21.97	20.02	18.41	13.71	14.16
Jan	1989	130.7	146.8	21.22	19.45	18.14	13.75	13.82
Feb	1989	130.8	147.8	22.05	19.51	18.26	13.79	13.89
Mar	1989	131.3	148.5	21.90	19.65	18.35	13.62	14.10
Apr	1989	131.3	149.0	22.37	19.80	18.40	13.57	14.16
May	1989	131.4	150.5	21.89	20.02	18.17	13.76	14.27
June	1989	131.5	151.3	21.89	20.02	18.17	13.76	13.22
July	1989	131.4	152.3	21.67	19.60	17.96	13.57	12.98
Aug	1989	131.3	152.4	20.97	19.76	18.24	13.52	14.30
Sept	1989	131.0	152.6	21.97	20.61	18.73	13.68	14.83
Oct	1989	130.8	153.2	22.26	20.71	18.74	13.99	14.77
Nov	1989	130.6	153.7	22.60	20.64	18.78	13.93	14.75
Dec	1989	130.2	153.6	22.80	20.50	18.93	13.62	14.77
Jan	1990	130.4	154.9	21.88	20.39	19.03	13.99	14.78
Feb	1990	131.3	155.8	22.51	20.63R	19.14R	14.49	15.03R
Mar	1990	131.6	156.3	22.52P	20.70P	19.17P	14.98P	15.10P
Apr	1990	131.4	156.4	—	—	—	—	—

P = Preliminary R = Revised since last month

¹Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

²Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

³Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

GOVERNMENT STATISTICS

SOUTH AFRICA							
		Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand) ¹	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982 = 100) ²	Consumer Price Index ³ (1985 = 100)	Production Price Index All Groups ⁴ (1985 = 100)	Total Employment in Mining and Quarrying ⁵	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) ⁵
							Annual Total ⁶
1980	Avg.	35.53	—	51.9	55.2	709,042	2,237,689
1981	Avg.	41.89	—	59.8	62.7	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	71.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	79.0	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	85.6	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	100.0	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	119.5	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	136.2	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	154.1	705,355	7,774,054
1989	Avg.	116.65	273.0	178.2	177.5	700,360	8,833,939
							Monthly Total
Jan	1989	—	—	166.8	165.5	714,593	704,320
Feb	1989	—	—	168.2	168.5	696,329	669,983
Mar	1989	112.29	262.8	170.9	171.1	702,746	695,843
Apr	1989	—	—	173.1	173.8	658,677	634,344
May	1989	—	—	175.9	176.4	706,056	721,263
June	1989	113.76	267.0	177.7	177.1	706,810	720,586
July	1989	—	—	179.3	178.8	711,648	775,002
Aug	1989	—	—	181.8	180.7	703,812	793,475
Sept	1989	119.76	280.2	183.4	181.7	708,222	780,723
Oct	1989	—	—	185.1	183.9	689,017	737,723
Nov	1989	—	—	187.0	185.6	704,025	790,375
Dec	1989	120.79	282.0	189.4	187.2	702,382	810,302
Jan	1990	—	—	192.0	188.8	688,837	801,616
Feb	1990	—	—	193.3	190.3	—	—
Mar	1990	126.74	296.3	196.4	190.9	—	—
Apr	1990	—	—	198.3	—	—	—

P = Preliminary R = Revised since last month

¹Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

²Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

³Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 236.

⁴Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

⁵Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

⁶Annual total is shown, rather than monthly average for indicated year.

GOVERNMENT STATISTICS

UNITED STATES									
						Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴			
		Producer Price Index ¹		Consumer Price Index ²	GNP Implicit Price Deflator ³				
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
1989	Avg.	111.6	112.2	124.0	126.6	13.67	13.75	13.06	10.38
Jan	1989	109.4	110.5	121.1	—	13.80	13.49	12.85	10.27
Feb	1989	110.1	110.8	121.6	—	13.66	13.48	12.88	10.26
Mar	1989	110.5	111.5	122.3	125.4	13.71	13.51	12.91	10.30
Apr	1989	111.8	112.3	123.1	—	13.68	13.65	12.92	10.31
May	1989	112.1	113.2	123.8	—	13.60	13.57	12.98	10.33
June	1989	112.4	112.9	124.1	126.0	13.62	13.66	12.98	10.37
July	1989	112.2	112.8	124.4	—	13.70	13.75	13.12	10.41
Aug	1989	111.4	112.0	124.6	—	13.64	13.72	13.08	10.40
Sept	1989	111.9	112.4	125.0	126.8	13.70	13.99	13.18	10.47
Oct	1989	112.4	112.8	125.6	—	13.76	13.94	13.25	10.43
Nov	1989	112.2	112.7	125.9	—	13.69	14.12	13.26	10.47
Dec	1989	112.3	113.0	126.1	128.0	13.51	14.16	13.31	10.52
Jan	1990	114.2	114.9	127.4	—	13.75	13.95	13.31	10.50
Feb	1990	113.6	114.4	128.0	—	13.75	13.98R	13.24R	10.54R
Mar	1990	113.2	114.2	128.7	129.7	13.78P	14.02P	13.29R	10.58P
Apr	1990	113.1	114.0	128.9	—	—	—	13.44P	10.58P

P = Preliminary R = Revised since last month

¹US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

²US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

³US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

⁴US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

GOVERNMENT STATISTICS

VOLUME AND PRICE OF URANIUM DELIVERIES TO THE EUROPEAN COMMUNITY¹ (Compiled from data published by the Euratom Supply Agency)						
Year	Volume of Deliveries to the EC ² (MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ³ Average Price		Spot Contracts ³ Average Price	
			in ECU per pound U ₃ O ₈	in US Dollars per pound U ₃ O ₈	in ECU per pound U ₃ O ₈	in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,500	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65	\$16.13
1989	13,500	11.5	ECU 26.63	\$29.35	ECU 11.04	\$12.19

R = Revised

¹ The twelve European Community member nations are Belgium, Denmark, France, West Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

² The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³ For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar. Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

GOVERNMENT STATISTICS

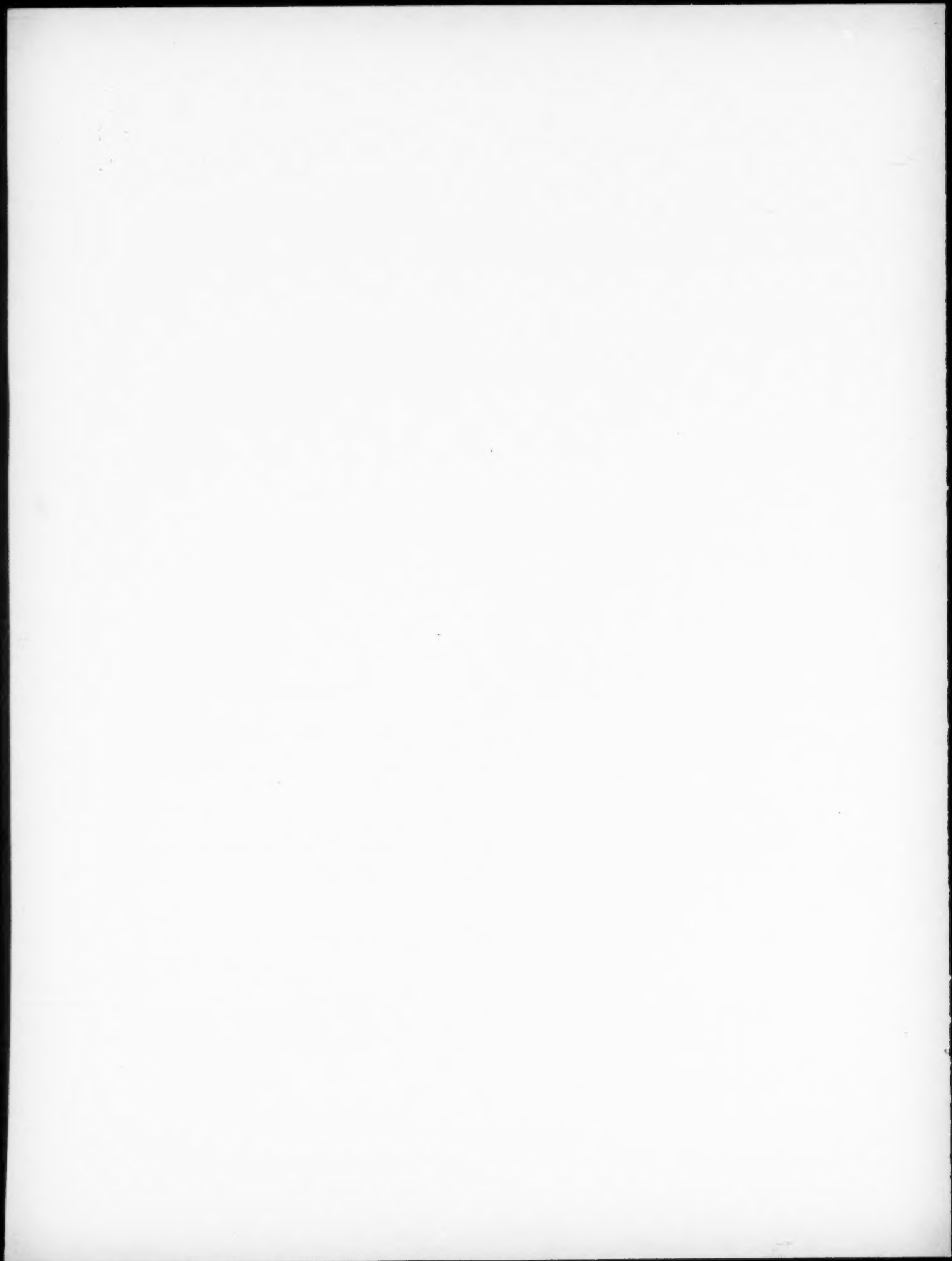
US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	\$16.10	3.6	n/a	1.2
1977	29.9	27.8	\$19.75	5.6	n/a	4.0
1978	37.0	31.6	\$21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agents

³ Includes imports by domestic utilities and domestic suppliers



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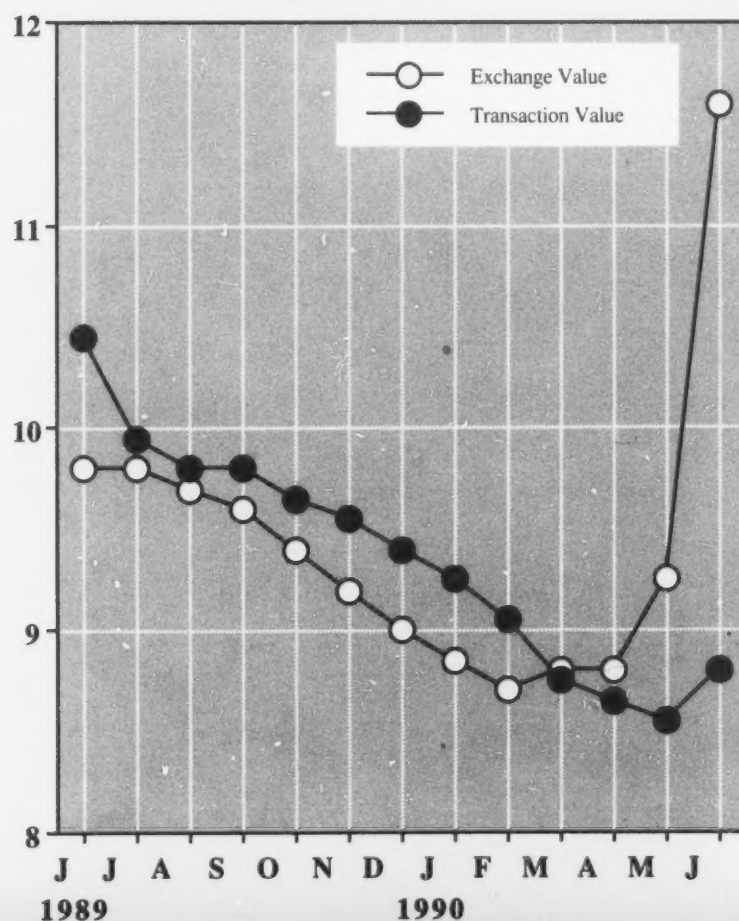
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NUEXCO

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• Nukem Ownership Change • SWAPO Nationalization Policy Uncertain • Washington Focus • Industry Briefs	
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• First Half 1990 Market Review	20
Within the first six months of 1990, the near-term uranium market has seen a 33-percent rise in the Exchange Value, a 31-percent increase in the UF ₆ Value, and sales of almost 23 million pounds equivalent U ₃ O ₈ . NUEXCO examines some of the factors that contributed to this rapid price rise and record-high market volume.	
• World Uranium Requirements	22
Through the year 2005, NUEXCO projects the cumulative world uranium requirements to exceed 2.2 billion pounds equivalent U ₃ O ₈ or an average of 138 million pounds per year. The expect growth rate is 1.4 percent per year through 2000. Requirements from the USA and Europe will grow more slowly than from the Far East and other countries, but four countries (the USA, France, Japan, and West Germany) still will account for 75 percent of the total.	
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To Our Readers

Please note that, as of this issue, we have made improvements to the *Supply and Demand* tables in the Market Review section. Loan supply and demand are now included as subsections within the uranium supply and uranium demand tables, respectively. A second improvement affects all four supply and demand tables. Active supply and demand items are still listed individually, but inactive supply and demand, also previously listed by item, are now presented as aggregate totals.

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MARKET REVIEW
MARKET VALUES SUMMARY

June 30, 1990

NUEXCO Market Values	This Report June 30, 1990	Last Report May 31, 1990	12 Months Ago June 30, 1989
EXCHANGE VALUE¹	\$11.60/lb equivalent U₃O₈	\$9.25	\$9.80
UF₆ VALUE²	\$32.00/kg U as UF₆	\$25.50	\$30.25
LOAN RATE³	3.5% / annum	3.5%	3.5%
CONVERSION VALUE⁴	\$1.45/lb U as UF₆	\$1.45	\$1.95
SWU VALUE⁵ (0.3 tails assay)	\$50/SWU	\$50	\$66
TRANSACTION VALUE⁶	\$8.80/lb equivalent U₃O₈	\$8.55	\$10.45
Transactions	38	27	27
Months	3	3	3
Millions of Pounds	11.3	9.9	5.5

DEFINITIONS

¹ The **Exchange Value** is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

² The **UF₆ Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

³ The **Loan Rate** is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

⁴ The **Conversion Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

⁵ The **SWU Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

⁶ The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:

- Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
- At least ten transactions;
- Transactions involving a sum total of at least 2 million pounds equivalent U₃O₈.

DERIVATIONS AND COMMENTS

- All **Market Values** are expressed in terms of US\$.
- All **Market Values** are based on:
 - Data from recently completed transactions.
 - Data from pending transactions.
 - Firm bids to buy or borrow, and firm offers to sell or lend.
 - Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend.
- Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these **Market Values**.
- In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers.
- The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
- For the **SWU Value**, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the NUEXCO **Exchange Value** and **Conversion Value** determined as of the same date.
- In calculating the **Transaction Value**, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future **Exchange Values** or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined.
- The sample time for the **Transaction Value** is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

MARKET REVIEW

JUNE MARKET REVIEW

(as of June 30, 1990)

OVERVIEW

Price levels and trading volume in the natural uranium market increased rapidly all month, accelerating upward during the second half of June. The June 30 Exchange Value and the UF₆ Value each rose a record 25 percent from their May 31 levels, to \$11.60 per pound U₃O₈ and \$32.00 per KgU as UF₆, respectively. In the uranium market, transactions totalled over eight million pounds in 25 sales. Almost four million pounds equivalent U₃O₈ changed hands in twenty-two near-term sales. Twelve involved concentrates, nine UF₆, and one involved enriched uranium product (EUP). The June transactions bring the half-year total of near-term market activity to 69 sales involving nearly 23 million pounds equivalent U₃O₈ (Table 1). The article on page 20 of this issue reviews market activity for the first half of 1990. In addition, three long-term sales concluded in June totalled over four million pounds equivalent U₃O₈ for delivery through 2001.

The Loan Rate, Conversion Value, and SWU Value all remained unchanged from their May 31 levels. One June loan for concentrates is reported. Utilities made four secondary market conversion purchases.

The SWU market was quite active, as seven SWU sales totalled over 850 thousand SWU. Three near-term SWU sales totalled over 100 thousand SWU; the remaining sales were long-term SWU contracts for delivery during the period 1991-1993.

NATURAL URANIUM AND CONVERSION

Short-term Market Activity

The Exchange Value's June 30 rise of \$2.35, to \$11.60 per pound U₃O₈, represents a 25-percent increase, the largest in its twenty-two year history. Due to the market's rapid rise, sales closed at successively higher prices throughout June. The month began with a high degree of uncertainty in the market; buyers and sellers were unsure if the market had bottomed, and if so, whether the five percent rise of May 31 signalled a turnaround. The pace at which prices rose during the month, particularly after years of gradual, steady decline, took many market participants by surprise, and resulted in further uncertainty. Due to the rate of the price increases, offers often lagged current price levels only days after they were issued, making it difficult for market participants to accurately assess current market levels. The market was primarily driven by activity in North America, as the market in Europe was relatively quiet in comparison.

Twelve June concentrates sales involved over two million pounds equivalent U₃O₈. Producers made most of the purchases, but three utilities also bought material. Four US utilities are evaluating offers as well. Producers remain very active as buyers in the spot concentrates market, filling contract requirements and making discretionary purchases. However, as prices approach higher levels, some producers may resume uranium production and revert to their traditional roles as sellers in the market. If so, significant changes in the supply and demand balance could result.

The number of near-term uranium sales so far this year totals 69. If this pace continues through the end of the year, it would establish a new annual record for number of spot uranium transactions. One reason for the large number of transactions may be, that while an oversupply of uranium still exists, fewer suppliers are selling large quantities in the near term. Therefore, buyers purchasing a substantial quantity for short-term delivery are sometimes unable to find the whole quantity in a single offer. Buyers then contract with several suppliers to achieve the desired

Table 1
SPOT URANIUM SALES SUMMARY

	June 1990		Year-to-Date	
	No. of Sales	Volume ¹	No. of Sales	Volume ¹
Concentrates	12	2.2	35	9.0
UF ₆	9	1.4	25	9.4
EUP	1	0.3	9	4.2
Total	22	3.9	69	22.6

¹ Million Pounds Equivalent U₃O₈

MARKET REVIEW

purchase quantity, or spread purchases over a longer period of time. Either result increases the number of sale transactions and may reduce their average size. Thus, for example, instead of one purchase for 500 thousand pounds U₃O₈, a buyer may make three purchases for a *total* of 500 thousand pounds.

* * *

The **UF₆ Value** jumped to **\$32.00** per KgU as UF₆ on June 30. This \$6.50 increase is the largest increase, both in absolute terms and as a percentage, in the five-year history of the UF₆ Value. Nine near-term UF₆ sales totalling 1.4 million pounds equivalent U₃O₈ took place in June. Market activity in North America predominated in the UF₆ market as well; eight of the nine buyers were North American, as were at least five of the nine sellers. Six utilities purchased UF₆ during June. Price levels in the natural UF₆ market behaved similarly to the concentrates market, increasing steadily throughout the month. The oversupply of UF₆ (particularly in Europe) that has loomed over the market for much of the year and exerted downward pressure on prices has dissipated. Thus the concentrates and UF₆ markets are responding faster to temporary changes in supply and demand than in past months.

Table 2
NEAR-TERM SUPPLY/DEMAND SUMMARY

	Active Supply ¹	Active Demand ¹
• Natural Uranium ² (thousand lbs equivalent U ₃ O ₈)	5,175	3,470
• Supply/Demand Ratio:		1.5
• Loans (thousand lbs equivalent U ₃ O ₈)	7,210	0
• Conversion (thousand lbs U as UF ₆)	0	670
• SWU (thousand SWUs)	435	15

¹ Supply and demand tables in the current market data section of this Report provide details for each category.
² Includes concentrates and hexafluoride.

The **Transaction Value** increased \$0.25 this month to **\$8.80** per pound U₃O₈ based on 38 transactions over 3 months involving 11.3 million pounds. By definition, the weighted, moving average used to calculate the Transaction Value is slow to respond to market changes. This is the first upward movement of the Transaction Value since September 1987.

* * *

Active uranium supply increased to **5.2** million pounds equivalent U₃O₈, while **active uranium demand** declined slightly to **3.5** million pounds equivalent U₃O₈ (**Table 2**). The **supply/demand ratio** climbed to **1.5**, marking the first time in three months that supply has exceeded demand. Additional supply can be expected to emerge in response to the higher prices prevailing in the current market.

Many buyers and sellers evaluate loan material and sale material as virtually equivalent when estimating the supply available to fill near-term demand. While loans only defer demand rather than fill it, the term for loan repayment effectively changes the supply/demand situation in today's very active market. Reflecting that widely-held perception, NUEXCO has revised the format of the supply and demand listings found on pages 7-8. Active supply and demand items are still listed individually, but inactive supply and demand are now listed only as aggregate totals.

* * *

Long-Term Natural Uranium Market Activity

Three long-term natural uranium sales totalling over four million pounds equivalent U₃O₈ are reported this month. Three European utilities purchased material for delivery during 1991 to 2001. Two sales involved concentrates, the other involved UF₆.

* * *

The **Loan Rate** remains at **3.5** percent per annum. The one loan reported this month, in which an intermediary borrowed from a producer, took place near the prevailing Loan Rate. Loan supply remains plentiful.

MARKET REVIEW

The **Conversion Value** remains at \$1.45 per pound U as UF₆. The four June sales, all with US utilities as buyers, totalled over 800 thousand pounds U as UF₆. The easing of the UF₆ supply glut, and the recent price jumps of the Exchange Value and UF₆ Value, have reduced some of the downward pressure on the Conversion Value. Although UF₆ is still selling at a discount compared to the sum of its components—concentrates and conversion—the discount has decreased recently as the concentrates and the UF₆ markets have tended to behave more consistently with one another.

ENRICHMENT SERVICES AND ENRICHED URANIUM PRODUCT

The **SWU Value** remains unchanged at \$50 per SWU, marking the fifth consecutive month at that level. However, unlike recent months when only limited activity occurred in the SWU market, intermediaries sold 850 thousand SWU in seven different sales during June. Three sales totaled over 100 thousand SWU for near-term delivery; the remaining four sales involved nearly 750 thousand SWU for medium-term delivery to utilities during

the period 1991-1993. Active SWU supply continues to exceed active SWU demand.

One sale of EUP is also reported this month. A utility purchased over 300 thousand pounds equivalent U₃O₈ from an intermediary for delivery in 1991. ■

Table 3
ENRICHMENT PRICES
(June 30, 1990)

Prices	This Month Report 263	Last Month Report 262	12 Months Ago Report 251
NUEXCO SWU Value (\$US per SWU)	50	50	66
US DOE SWU prices: (\$US per SWU)			
USEC	117.85 ¹	117.85 ¹	117.00 ²
AFC	153.00 ³	153.00 ³	153.00 ³
Requirements	157.00 ³	157.00 ³	157.00 ³
Incentive Price (IP1)	90.00 ⁴	90.00 ⁴	90.00 ⁴
Calculated worth of enriched UF₆⁵: (\$US per KgU as UF ₆)			
2.5 w/o U ₂₃₅	306	274	328
3.0 w/o U ₂₃₅	391	351	422
3.5 w/o U ₂₃₅	478	430	519
4.0 w/o U ₂₃₅	565	510	617

¹ Effective 10/1/89 to 9/30/90.

² Effective 10/1/87 to 9/30/89.

³ Effective since 10/1/84.

⁴ Effective 10/1/86 to 9/30/90, for up to 30% of annual requirements.

⁵ Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 w/o tails assay.

MARKET REVIEW

RECENT TRANSACTIONS

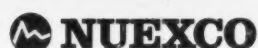
URANIUM SALES¹

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U ₃ O ₈)	Approximate Price Range ² as Percent of Current Exchange Value or UF ₆ Value	Buyer	Seller	Remarks
4858	1991	301-600	78-82	Utility	Intermediary	UF ₆
4859	1990	Less Than 50	R ³	Intermediary	R ³	UF ₆
4860	1990	50-100	83-87	Producer	Intermediary	
4861	1990	50-100	83-87	Producer	Intermediary	
4862	1990	101-300	83-87	Utility	Intermediary	UF ₆
4864	1990	101-300	83-87	Producer	Intermediary	
4865	1990	301-600	78-82	Producer	Intermediary	
4866	1990	101-300	88-92	Producer	Intermediary	
4867	1990	101-300	88-92	Producer	Intermediary	
4870	1990	101-300	R ³	R ³	R ³	UF ₆
4871	1990	50-100	88-92	R ³	Producer	
4872	1990	101-300	93-97	Producer	Intermediary	
4873	1990	101-300	93-97	Producer	Intermediary	UF ₆
4874A	1991	301-600	See Remarks	Utility	Intermediary	Contained in EUP
4875	1990	50-100	93-97	Producer	Producer	
4876	1991	101-300	88-92	Utility	Intermediary	UF ₆
4882	1992-2001	1,001-3,000	R ³	Utility	R ³	
4887	1992	101-300	R ³	Utility	Intermediary	UF ₆
4888	1991-2000	1,001-3,000	See Remarks	Utility	Producer	Base Price Escalated
4889	1990	Less Than 50	88-92	Utility	Intermediary	UF ₆
4891	1990	101-300	83-87	Utility	Intermediary	UF ₆
4892	1991	101-300	83-87	Utility	Intermediary	UF ₆
4893	1990	50-100	R ³	Utility	Producer	
4894	1991	101-300	R ³	Utility	Producer	
4895	1991	101-300	R ³	Utility	Producer	

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range.

³ The notation **R** means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.



MARKET REVIEW

LOAN TRANSACTIONS ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U ₃ O ₈)	Approximate Price Range ² as Percent of Current Loan Rate	Borrower	Lender	Remarks
4868	1990	101-300	98-102	Intermediary	Producer	
CONVERSION SERVICES SPOT MARKET SALES ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds U as UF ₆)	Approximate Price Range ² as Percent of Current Conversion Value	Buyer	Seller	Remarks
4863	1991	101-300	98-102	Utility	R ³	
4877	1990	301-600	83-87	Utility	Intermediary	
4896	1991	101-300	103-107	Utility	Converter	
4897	1991	101-300	108-112	Utility	Converter	
ENRICHMENT SERVICES SECONDARY MARKET SALES ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity ⁴ (thousand SWUs)	Approximate Price Range ² as Percent of Current SWU Value ⁵	Buyer	Seller	Remarks
4874B	1991	50-100	See Remarks	Utility	Intermediary	Contained in EUP
4878	1991-1993	101-300	See Remarks	Utility	Intermediary	Base Price Escalated
4879	1991-1993	101-300	See Remarks	Utility	Intermediary	Base Price Escalated
4880	1991-1993	50-100	See Remarks	Utility	Intermediary	Base Price Escalated
4881	1990	Less Than 50	98-102	Intermediary	Intermediary	
4886	1991-1993	101-300	See Remarks	Utility	Intermediary	Base Price Escalated
4890	1990	Less Than 50	108-112	Utility	Intermediary	
¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information. ² The range reflects five percentage points (inclusive) per grouping, centered about the middle of the range. ³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality. ⁴ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 w/o tails assay. ⁵ Prices are usually normalized to 0.30 w/o tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.						

MARKET REVIEW

SUPPLY AND DEMAND

Uranium Supply

(June 30, 1990)

NUEXCO Project Number	Quantity (Thousand Pounds equivalent U3Os)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Available for Sale				
ACTIVE				
90-1078A	2,175	2,175 per year	1991-1993	UF6e
90-7001*	3,000	3,000 per year	1991-1995	
Total	5,175			
INACTIVE				
	1,700			
Available for Loan				
ACTIVE				
88-1182	4,000	--	--	U3O8/UF6
90-1016	300	--	--	U3O8
90-1033	1,270	--	--	UF6
90-1108	1,000	--	--	U3O8
90-1110	250	--	--	U3O8
90-1115	390	--	--	UF6
Total	7,210			
INACTIVE				
	2,000			

* New or revised since last month.

¹ For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.

² For delivery beyond one year, measured from the date of this Report.

Projects removed since last month: 89-1201, 90-1027.

MARKET REVIEW

Uranium Demand

(June 30, 1990)

NUEXCO Project Number	Quantity (Thousand Pounds equivalent U ₃ O ₈)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Inquiries to Purchase:				
ACTIVE				
90-1100A	45	--	1991	UF ₆ e
90-1126	350	--	1991	
90-1138	350	--	1990	
90-1146*	450	--	1990	
90-1151*	230	--	1990	U ₃ O ₈ /UF ₆
90-1154*	500	--	1990	
90-1156*	250	--	1990	
90-1161*	260	--	1991	UF ₆
90-1163*	500	--	1990	U ₃ O ₈ /UF ₆
90-1166*	160	--	1990	
90-1167A*	300	--	1991	
90-1171*	75	--	1990	U ₃ O ₈ /UF ₆
90-1098	--	250 per year	1992-1994	
90-1113*	--	800	1991-1995	
90-1149*	--	300 per year	1992-2000	
90-1155*	--	325 per year	1991-1995	
Total	3,470			
INACTIVE	1,860			
Inquiries to Borrow	<i>No inquiries to borrow are reported</i>			
* New or revised since last month.				
¹ For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.				
² For delivery beyond one year, measured from the date of this Report.				
Projects removed since last month: 89-1233, 90-1024, 90-1077, 90-1092A, 90-1093A, 90-1111, 90-1114, 90-1119, 90-1120, 90-1121, 90-1125, 90-1139.				

Conversion Supply And Demand

(June 30, 1990)

NUEXCO Project Number	Quantity (Thousand Pounds U as UF ₆)		Remarks
	Within 3 Years ¹	Beyond 3 Years ¹	
Available for Sale	No offers to sell are reported		
Inquiries to Purchase			
ACTIVE			
90-1167B*	420	--	
90-1167C*	250	--	
Total	670		
INACTIVE			
None reported			
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: 89-7002, 90-1101, 90-1122, 90-1137.			

MARKET REVIEW

SWU Supply And Demand

(June 30, 1990)

NUEXCO Project Number	Quantity (Thousand SWUs)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Available for Sale				
ACTIVE				
90-1078B	435	435 per year	1991-1993	UF6e
90-7000*	----	1,000	1991 on	
Total	435			
INACTIVE				
<i>None reported</i>				
Inquiries to Purchase				
ACTIVE				
90-1100B	15	--	1991	UF6e
88-1061	--	500	1991-1995	
89-1262	--	120 per year	1996-1999	
90-1076	--	350 per year	1992-1998	
90-1094	--	500	1992-2000	
90-1144*	--	60 per year	1992-2001	
Total	15			
INACTIVE				
	1,545			

* New or revised since last month.

¹ For delivery within one year, measured from the date of this Report.
This category excludes SWU deliverable within one year under other than spot or near-term contracts.

² For delivery beyond one year, measured from the date of this Report.

Projects removed since last month: 90-1071, 90-1092B, 90-1093B, 90-1022A, 90-1022B, 90-1109.

MARKET REVIEW

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

EXCHANGE VALUE¹						
Country (currency)	per lb equivalent U3O8 as Concentrates			per kg U as Concentrates		
	This Month (June 30, 1990)	Last Month (May 31, 1990)	12 Months Ago (June 30, 1989)	This Month (June 30, 1990)	Last Month (May 31, 1990)	12 Months Ago (June 30, 1989)
Australia (dollar)	14.74	11.98	12.98	38.32	31.14	33.75
Belgium (franc)	398.63	320.18	401.80	1,036	832.40	1,045
Canada (dollar)	13.56	10.88	11.71	35.24	28.28	30.45
EEC (ecu)	9.38	7.54	9.22	24.39	19.59	23.98
Finland (markka)	45.58	36.40	43.29	118.49	94.63	112.53
France (franc)	65.14	52.50	65.29	169.35	136.48	169.74
Italy (lira)	14,233	11,451	13,917	37,003	29,770	36,180
Japan (yen)	1,775	1,400	1,408	4,614	3,641	3,660
Netherlands (guilder)	21.83	17.52	21.66	56.76	45.55	56.30
So. Africa (comm. rand)	30.79	24.54	27.09	80.06	63.79	70.44
Spain (peseta)	1,191	965.65	1,223	3,097	2,510	3,180
Sweden (krona)	70.22	56.20	65.29	182.55	146.10	169.74
Switzerland (franc)	16.48	13.17	16.50	42.84	34.23	42.89
UK (pound)	6.67	5.45	6.34	17.35	14.18	16.47
US (dollar)	11.60	9.25	9.80	30.16	24.05	25.48
West Germany (mark)	19.39	15.57	19.22	50.42	40.47	49.97

TRANSACTION VALUE¹						
Country (currency)	per lb equivalent U3O8 as Concentrates			per kg U as Concentrates		
	This Month (June 30, 1990)	Last Month (May 31, 1990)	12 Months Ago (June 30, 1989)	This Month (June 30, 1990)	Last Month (May 31, 1990)	12 Months Ago (June 30, 1989)
Australia (dollar)	11.18	11.07	13.84	29.07	28.79	35.99
Belgium (franc)	302.41	295.95	428.45	786.19	769.40	1,114
Canada (dollar)	10.28	10.06	12.49	26.74	26.14	32.47
EEC (ecu)	7.12	6.96	9.83	18.51	18.11	25.57
Finland (markka)	34.57	33.64	46.16	89.89	87.47	120.00
France (franc)	49.42	48.52	69.62	128.47	126.15	181.00
Italy (lira)	10,798	10,584	14,840	28,071	27,517	38,579
Japan (yen)	1,346	1,294	1,501	3,500	3,365	3,903
Netherlands (guilder)	16.56	16.20	23.09	43.06	42.11	60.04
So. Africa (comm. rand)	23.36	22.68	28.89	60.73	58.96	75.11
Spain (peseta)	903.77	892.58	1,304	2,350	2,321	3,391
Sweden (krona)	53.27	51.94	69.62	138.49	135.04	181.00
Switzerland (franc)	12.50	12.17	17.59	32.50	31.64	45.74
UK (pound)	5.06	5.04	6.76	13.16	13.11	17.57
US (dollar)	8.80	8.55	10.45	22.88	22.23	27.17
West Germany (mark)	14.71	14.39	20.49	38.25	37.41	53.28

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

MARKET REVIEW

CONVERSION VALUE¹

Country (currency)	per lb U as UF ₆			per kg U as UF ₆		
	This Month (June 30, 1990)	Last Month (May 31, 1990)	12 Months Ago (June 30, 1989)	This Month (June 30, 1990)	Last Month (May 31, 1990)	12 Months Ago (June 30, 1989)
Australia (dollar)	1.84	1.88	2.58	4.06	4.14	5.70
Belgium (franc)	49.83	50.19	79.95	109.85	110.65	176.26
Canada (dollar)	1.69	1.71	2.33	3.74	3.76	5.14
EEC (ecu)	1.17	1.18	1.84	2.59	2.60	4.05
Finland (markka)	5.70	5.71	8.61	12.56	12.58	18.99
France (franc)	8.14	8.23	12.99	17.95	18.14	28.64
Italy (lira)	1,779	1,795	2,769	3,922	3,957	6,105
Japan (yen)	221.85	219.53	280.13	489.09	483.98	617.58
Netherlands (guilder)	2.73	2.75	4.31	6.02	6.06	9.50
So. Africa (comm. rand)	3.85	3.85	5.39	8.49	8.48	11.89
Spain (peseta)	148.92	151.37	243.38	328.30	333.72	536.57
Sweden (krona)	8.78	8.81	12.99	19.35	19.42	28.64
Switzerland (franc)	2.06	2.06	3.28	4.54	4.55	7.24
UK (pound)	.83	.85	1.26	1.84	1.88	2.78
US (dollar)	1.45	1.45	1.95	3.20	3.20	4.30
West Germany (mark)	2.42	2.44	3.82	5.34	5.38	8.43

SWU VALUE AND UF₆ VALUE¹

Country (currency)	SWU Value at 0.30% Tails Assay			UF ₆ Value per kg U as UF ₆		
	This Month (June 30, 1990)	Last Month (May 31, 1990)	12 Months Ago (June 30, 1989)	This Month (June 30, 1990)	Last Month (May 31, 1990)	12 Months Ago (June 30, 1989)
Australia (dollar)	63.54	64.75	87.44	40.67	33.02	40.07
Belgium (franc)	1,718	1,731	2,706	1,100	882.66	1,240
Canada (dollar)	58.43	58.80	78.87	37.40	29.99	36.14
EEC (ecu)	40.44	40.73	62.11	25.88	20.77	28.46
Finland (markka)	196.45	196.75	291.52	125.73	100.34	133.61
France (franc)	280.77	283.77	439.71	179.69	144.72	201.53
Italy (lira)	61,350	61,897	93,723	39,264	31,567	42,957
Japan (yen)	7,650	7,570	9,481	4,896	3,861	4,346
Netherlands (guilder)	94.11	94.71	145.86	60.23	48.30	66.85
So. Africa (comm. rand)	132.73	132.63	182.47	84.95	67.64	83.63
Spain (peseta)	5,135	5,220	8,238	3,286	2,662	3,776
Sweden (krona)	302.66	303.77	439.71	193.70	154.92	201.53
Switzerland (franc)	71.02	71.17	111.11	45.45	36.30	50.92
UK (pound)	28.76	29.48	42.68	18.41	15.04	19.56
US (dollar)	50.00	50.00	66.00	32.00	25.50	30.25
West Germany (mark)	83.60	84.15	129.44	53.50	42.91	59.32

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

RECENT DEVELOPMENTS

WEST GERMANY

Nukem Ownership Change

RWE AG has agreed to purchase the 35-percent interest in Nukem GmbH from Degussa AG, a metal and chemical company. This boosts the interest held by RWE, West Germany's largest utility and energy concern, to a 90-percent ownership share in Nukem, up from 55 percent. RWE had increased its share from 45 percent to 55 percent in June 1989 when it purchased the 10-percent interest held by Imperial Smelting Corporation of the UK, a wholly-owned subsidiary of the RTZ Corporation. The latest transaction continues the consolidation and reorganization of the German nuclear industry that began in late 1987. Degussa stated that the redirection of Nukem's activities away from the fuel fabrication industry and toward solar energy and process engineering has been successfully initiated, and has resulted in Nukem being more closely associated with RWE.

Nukem's nuclear fuel cycle services unit remains active in the uranium market. In 1989 it successfully bid to purchase about one-quarter of the BMFT (German Ministry for Research and Technology) enriched uranium stockpile, a share valued at 100 million Deutschemarks. The company has agreed to purchase and is currently in final negotiations with Queensland Mines Limited (QML) of Australia to buy QML's uranium inventory and contractual obligations. Nukem is also associated with US Energy, a US uranium production company.

The diagram (**Figure 1**) on the following page shows the basic structure of the West German nuclear fuel industry following the Nukem ownership changes. The diagram does not include the ownership structure of each company; rather, it focuses on some of the key organizations and their most important activities. The accompanying sidebar provides a chronology of some of the major events and structural changes that have affected Nukem. □

Chronology of Major Events

Fall 1987

Following allegations of wrongdoing, the West German government begins an investigation of Transnuklear-Hanau (TNH), a subsidiary of Nukem responsible for nuclear fuel and waste transportation. The West German government announces its intention to reorganize and simplify the nuclear fuel industry in Germany.

March 1988

Nukem begins implementing a plan to sell all of its shares in TNH, including agreeing to sell TNH's non-German subsidiaries to Transnucléaire, Paris. Degussa AG takes over management of Nukem. Nukem also moves to dispose of its fuel fabrication activities.

September 1988

Nukem sells its 40-percent interests in ALKEM GmbH and RBU GmbH to Siemens AG as part of its redirection away from nuclear fuel fabrication, and toward a concentration on engineering, production, and services. Siemens now effectively owns 100 percent of both firms and combines ALKEM and RBU to form Siemens-Brennelementewerk Hanau (SBH).

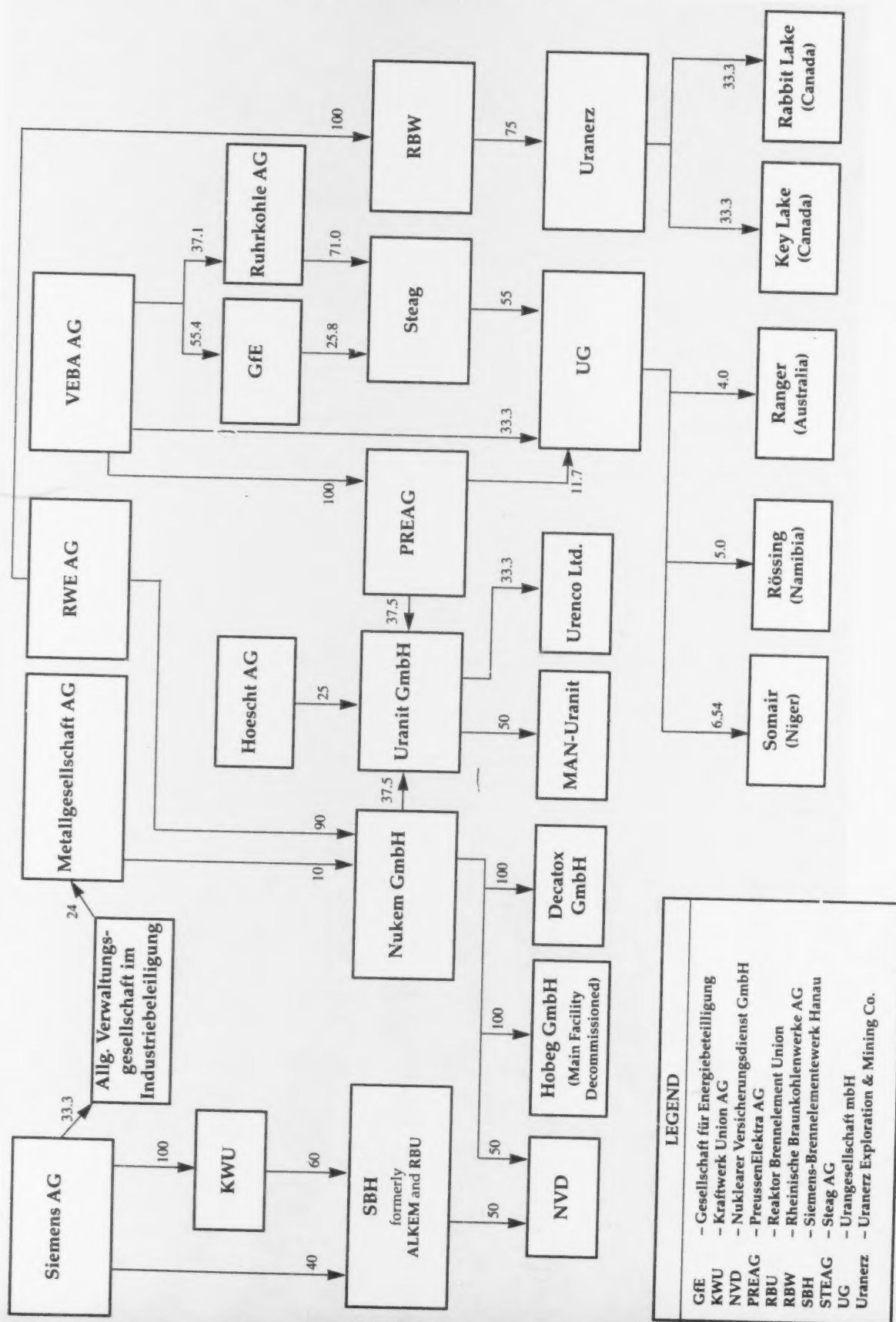
June 1989

RWE becomes the 55-percent majority shareholder in Nukem, when it purchases the ten percent interest held by Imperial Smelting Corp. (ISC)—a wholly-owned subsidiary of the RTZ Corporation (UK). RWE begins to exert management control over the organization. Degussa owns 35 percent, and Metallgesellschaft AG owns the other 10 percent.

June 1990

RWE buys Degussa's 35-percent interest in Nukem, boosting its ownership to 90 percent. Metallgesellschaft remains as a 10-percent minority owner.

Figure 1
German Nuclear Fuel Industry—Basic Ownership Structure (RWE and VEBA interests)



RECENT DEVELOPMENTS**NAMIBIA****SWAPO Nationalization Policy Uncertain**

The South West Africa People's Organization's (SWAPO) moderate pre-election stance on the nationalization of Namibian industry appears to be shifting, at least in regard to mining. Although Andimba Toivo ya Toivo, Namibia's Minister of Mines and Energy, recently stated that any mine ownership changes would be made slowly to avoid disrupting current production levels, he also said that the outflow of dividend income to other countries would have to be reduced. Any changes would have an affect on Rössing, the world's second largest uranium producer.

SWAPO recently conducted a review of the mining industry, with primary assistance from the Commonwealth Fund for Technical Assistance (CFTC) through its Technical Assistance Group (TAG). The group discussed its recommendations with SWAPO in May, at which time the government asked TAG to draft new mining legislation. TAG's primary recommendation is to boost the state's earnings by increasing the flow of tax revenues from current operations rather than changing the ownership

structure of the industry. If SWAPO elects to implement these recommendations, TAG estimates the state's revenues from mining would rise by about six percent. Although Namibia does not wish to discourage foreign investment, TAG released a policy document in June which noted that mining projects might carry some government ownership requirements in the future.

SWAPO is negotiating a joint venture in the diamond industry with CDM (a De Beers subsidiary, which accounts for 50 percent of Namibia's mineral exports), and will likely participate in CDM's marketing. No immediate changes are expected at the Rössing mine, in which the government holds a 3.5-percent equity interest as well as 50 percent of the voting rights. And until Namibia drafts new mining legislation, Rössing will remain subject to South Africa's Nuclear Energy Act. Since mining accounts for 80 percent of Namibia's exports and more than a third of its domestic revenues, however, the mining industry will continue to be an attractive target for nationalization. ■

RECENT DEVELOPMENTS

WASHINGTON FOCUS

Congress has made progress on key legislation this summer. The House of Representatives passed an appropriations bill which authorizes spending for DOE and the NRC for FY91. The Senate has yet to consider an energy appropriations bill, but as the House bill exceeds the administration request for funding by \$575 million, it will likely experience substantial cuts before its final passage. At the end of the month, the Senate Energy & Natural Resources Committee held a hearing on the Smith Barney report on the Uranium Enrichment Enterprise. Since the Senate has already passed a uranium enrichment restructuring bill, attention has shifted to the House where some Representatives have expressed interest in holding a hearing on the report.

After almost a month's delay, the House has named its representatives to the Clean Air Act Conference Committee. The Senate will have nine committee members, and the House will have 142 conferees from seven committees. Final action on the clean air bill is likely before November's Congressional elections.

Finally, although it appeared the utilities had a chance to hold their payment of NRC user fees at 45 percent of the NRC's budget level, President Bush's decision to discuss taxes as part of the budget negotiations increases the likelihood of higher user fees—possibly as high as 100 percent of the NRC budget. The American Nuclear Energy Council (ANEC) estimates that the President's proposal to recover 100 percent of the NRC's budget through user fees is the second largest revenue item among the user fees proposed.

FY91 Energy Appropriations Bill

◇ The House approved the Energy and Water Development Appropriations bill for FY91 by a vote of 355 to 59. While some of DOE's nuclear activities received small increases over last year, the total budget for nuclear energy declined from almost \$582 million in FY90 to \$313.5 million in FY91. Some R&D priorities shifted as the House bill increased light water reactor (LWR) R&D from \$24.4 million in FY90 to \$31.5 million, and reduced advanced reactor R&D from \$58.8 million in FY90 to \$47 million in FY91.

The uranium enrichment program received its requested \$1.15 billion appropriation, since it is offset by revenues. AVLIS will be funded at the \$154.5 million level (a \$22.2-million increase from FY90). Although DOE based its budget request on the assumption that enrichment program restructuring legislation would be enacted, the House bill prohibits DOE from setting up accounts for a \$50-million decontamination and decommissioning fund, paying \$29 million on a \$364 million "debt," or creating a working capital fund of \$45 million for the future government corporation. The bill does not authorize DOE to purchase any enrichment services, noting that this issue, as well as the above accounts, should be discussed during debate on a restructuring bill. By denying the department this spending authority, the House has effectively created a \$124 million fund from utility revenues which the House can allocate among other programs. The House also approved \$293 million for the civilian nuclear waste program, \$2 million less than FY90.

RECENT DEVELOPMENTS**DOE June 22
Customer Meeting**

◇ DOE held its USEC customer meeting on June 22 in Washington, D.C. It announced there would be no price increase for FY91, and that the \$117.85 ceiling price currently in effect would remain through FY91. There is some indication that DOE may be considering what has been termed an Incentive Price III (IP3) or an alternative contract form in an effort to lock in customers prior to the expiration of their commitments in 1996. AVLIS remained a major topic of conversation at the meeting.

**Senate Hearing on
Smith Barney Report**

◇ On June 28 the Senate Energy R&D subcommittee held a hearing on the Smith Barney report. DOE Deputy Secretary Henson Moore and William H. Timbers, Jr., Managing Director of Smith Barney, Harris Upham & Company, testified. Prior to the hearing, Coopers & Lybrand, a subcontractor to Smith Barney, recalculated its figures for unrecovered costs based on Federal Energy Regulatory Commission rules on recovery of prudently incurred costs (a 50-50 split between customers and shareholders). In a letter to Mr. Timbers, Coopers states that its original calculation of approximately \$4.5 billion debt, less the 50 percent for policy costs of \$5.7 billion (TVA demand charges, GCEP abandonment, excess capacity), resulted in a net over-recovery as of September 30, 1989, of approximately \$1.2 billion.

DOE, in a letter from Assistant Secretary for Nuclear Energy Bill Young to Sen. Wendell Ford, concurred with the new analysis that there is no debt, and thus testified that the new enrichment corporation should be established with no initial debt. While DOE apparently agrees with most of the report's conclusions, as Moore's testimony revealed, DOE does not agree with them on the AVLIS deployment schedule and its costs.

Little was said about a possible agreement to purchase Soviet SWU, even though the report endorses the idea. Henson Moore, when asked about such a deal, indicated that an interagency review group was looking at it, but that DOE is more committed to moving a restructuring bill through Congress.

Efforts by the Senate, DOE, and industry lobbyists to create some interest in the House for a restructuring bill are succeeding. At least two committees—Interior and Science, Space & Technology—are planning to hold hearings on the Smith Barney report this summer. Unfortunately, it appears there will not be enough time in this legislative session for the House to consider a bill.

**Schedule for
AVLIS Deployment**

◇ Although DOE publicly disagreed with Smith Barney's assessment of DOE's ability to deploy AVLIS in a timely fashion, DOE is already behind on portions of its original schedule, published last January. Revisions to 10 CFR Part 725, which would allow industrial access to the AVLIS technology (which is classified as Restricted Data), were published two months behind schedule in April. Despite the delay, the comment deadline remains June 22, and the program will begin on schedule in August. The

RECENT DEVELOPMENTS

**Schedule for AVLIS
Deployment (cont.)**

Industrial Access program is on a parallel course with the Commercial Deployment Contractor selection process. A procurement board has been named, and a statement of work should be published sometime this summer. The industrial access program is meant to create a suppliers' network for the technology, as well as to allow access for potential contractors. According to a DOE official, one unclassified briefing is under consideration for qualified industrial participants.

On June 18, DOE published its notice of intent to prepare an environmental impact statement for potential AVLIS sites. While DOE announced it will only consider DOE sites, not all of its 47 sites will meet the criteria for consideration, such as experience with handling nuclear materials, and the existence of uranium processing facilities. According to the original schedule, draft siting criteria guidelines were to be issued in April, with a final notice in July. The actual notice, with comments due by July 19, reduces the amount of time for internal review before final site criteria are established, if DOE is to select a short list of alternative sites by December 1990. According to a DOE official, the fact that most of the logical site choices (the current GDP sites) are environmentally contaminated will not affect its decision-making process.

Work is proceeding on other parts of the AVLIS fuel cycle as planned. DOE is in the process of signing contracts with all five domestic fuel fabricators and has held meetings with the international fuel fabricators as well. These contracts ask the fabricators to look into the alterations necessary in their production processes for the AVLIS fuel cycle, and to consider whether sample testing will be necessary. Talks with the domestic converters have begun, but DOE (at Oak Ridge) is still working on the R&D for this process. The actual AVLIS process demonstration is still on schedule. Alignment of the lasers with the separators is scheduled to begin in October, with operational testing to start in April 1991. The first SWU is not scheduled to be produced until December 1991. The uranium enrichment branch has asked for the authority to increase its staff to handle the additional managerial and regulatory oversight necessary to move AVLIS forward, but DOE management has not yet authorized the additional staff. ■

INDUSTRY BRIEFS

Japan to Build 40 Nuclear Power Plants

According to a June 5 announcement by the Ministry of International Trade and Industry (MITI), Japan will add 40 nuclear power plants in the next 20 years. Japan's nuclear program prior to the announcement included 14 plants under construction plus 13 more planned. Japan currently has 38 operating plants supplying about eight percent of the country's electricity. MITI forecasts a 38-percent growth in Japan's electricity demand between 1988 and 2010.

♦ ♦ ♦

RWE Buys Degussa's Interest in Nukem

RWE AG, the West German industrial giant, bought Degussa AG's 35-percent interest in Nukem GmbH. RWE now holds a 90-percent interest in Nukem. (See article on page 13.)

♦ ♦ ♦

Soviet-E. German Uranium Project Restructured

The Soviet Union and East Germany have reached agreement to restructure the Wismut uranium project operated at Crossen in East Germany since the late 1940's. Discussions are underway concerning tailings disposal and other operational details.

Chinon A3 Shut Down

Electricité de France (EdF) closed Chinon A3, its oldest operating reactor, on June 15. The 500-MWe unit had operated for 24 years and produced 31.5 billion kilowatt hours of electricity. Only two operating GCRs remain in France—Bugey 1 and St. Laurent A2. Both are scheduled to be decommissioned in 1992.

♦ ♦ ♦

Italy to Close Last Two Nuclear Units

The Italian Parliament voted on June 13 to permanently close the country's last two nuclear plants, which have been mothballed since November 1987. The 270-MWe Trino PWR and the 862-MWe Caorso PWR will be decommissioned after 42 and 10 years, respectively, of operation. Italy continues to support passively safe reactor development.

♦ ♦ ♦

Rio Algom Buys Into Uranium Resources

Rio Algom Mining Corp. purchased 2,096,497 shares of Uranium Resources, Inc.'s (URI) common stock, as well as warrants for an additional 7,109,235 shares. The private transaction for nine million shares, which could be valued at up to \$22 million, represents about 25 percent of the company.

Duke to Sell Partial Interest in LES

As soon as Louisiana Energy Services (LES) receives an NRC license for its proposed enrichment facility, Duke Power Co., 29-percent owner in LES, plans to sell the large majority of its interest to help fund the plant's construction. Two of the three utility partners (Duke and Northern States Power) are seeking to recoup their investments in LES through rates.

♦ ♦ ♦

China To Accelerate Nuclear Power Program

China National Nuclear Corporation (CNNC) released plans to accelerate China's nuclear power program to alleviate its energy shortage. By the year 2000, nuclear generating capacity should reach 6,000 MWe, and an additional 6,000 MWe should be under construction. By 1991, China's first indigenous nuclear power plant, a 300-kWh PWR at Qinshan, is scheduled to enter commercial operation.

China also plans to construct an experimental reprocessing plant in Lanzhou, to begin operating in 1998. The plant will be capable of handling 100 kg of nuclear waste per day.

ANALYSIS AND COMMENTARY

FIRST HALF 1990 MARKET REVIEW

Uranium

On March 31, 1990, for the first time since September 1987, the NUEXCO Exchange Value (EV) increased, rising \$0.10 to \$8.80 per pound U₃O₈. The market responded cautiously, unsure if this price rise signalled a true market reversal or was merely an anomalous uptick. The April 30 EV was unchanged, but the EV's \$0.45 rise on May 31 and its \$2.35 increase on June 30 (a 25-percent rise and the highest percentage increase in its 22-year history), appeared to indicate that prices had bottomed, the long-awaited turnaround had occurred, and an uptrend was underway. This surprised some who had anticipated neither the timing of the upturn, nor the rapidity of the price rise. What factors led to the current price rise?

Uranium inventories are still well above optimal levels, and large quantities remain available for loan—factors which would seem to argue against any substantial or permanent price increase. But other factors and perceptions, which have grown in importance during the past few months, have come to dominate the market.

- ◆ Sharp reductions in near-term supply, as a result of record sales volume during the first half of the year, and the successive withdrawal of sellers (both traders and producers) from the market as prices declined;

- ◆ Heavy, visible, and continuing procurement activity of some producers (following their withdrawal from the market as sellers);

- ◆ Concerns that market participants with outstanding loans might suddenly become large buyers in order to replace material previously borrowed;

- ◆ Utility decisions, in anticipation of higher prices, to advance their procurement plans, thereby adding to near-term demand;

- ◆ Recognition that, in light of the longer-term supply/demand balance and uranium production costs, the very low absolute level of spot prices (below \$9.00) could not be maintained indefinitely.

These factors strengthened throughout the first two quarters of the year and contributed to the recent price increase.

Table 1
1990 NEAR-TERM
URANIUM SALES

	Volume (Million Pounds) Equivalent U ₃ O ₈	Number Of Sales
January	0.9	2
February	4.3	11
March	4.0	6
April	4.4	13
May	5.1	13
June	4.0	22
Total	22.7	69

Spot and Near Term Sales

As 1990 began, the erosion of uranium prices continued, as the January 31, 1990 EV declined another \$0.15 from the previous month. January was a typically slow month, and only two spot sales, totalling approximately 900 thousand pounds equivalent U₃O₈, occurred. Some potential buyers, anticipating further price weakening, hesitated to make purchase commitments. With spot prices below the \$9.00 level, sellers were equally hesitant to make sales commitments.

Active uranium supply (material available for sale at competitive prices) was abundant (over six million pounds equivalent U₃O₈) in January, and almost as much was available for loan. Although most of the supply took the form of concentrates, UF₆ was also in ample supply. As the first quarter progressed, market participants began to perceive a UF₆ oversupply and an impending shortage, at least in the near-term, of concentrates. Although the EV dropped \$0.15 more in February to \$8.70, it rose \$0.10 in March as active demand began to exceed active supply, intensifying concerns of tightening supply.

ANALYSIS AND COMMENTARY

Believing that the market bottom was near, many buyers scrambled to take advantage of the historically low prices. From February through April almost 13 million pounds equivalent U₃O₈ changed hands; near-term uranium sales volume surged to over five million pounds in May alone (Table 1). The EV remained at \$8.80 on April 30, 1990, but rose sharply to \$9.25 on May 31. On June 30, the EV jumped to \$11.60. Almost four million pounds equivalent U₃O₈ were sold in 22 sales during June.

Evidencing the high activity level of activity in the uranium market during the first six months of 1990, a record 23 million pounds equivalent U₃O₈ changed hands in 69 sales. Utilities purchased about half of this material, followed by producers at approximately 23 percent. Intermediaries bought 12 percent of all uranium, while other entities accounted for the remainder.

Sales by intermediaries exceeded 16 million pounds equivalent U₃O₈, accounting for more than two-thirds of the total. Utilities ranked second in selling volume, accounting for about 14 percent of the total. Producers were largely absent from the market as sellers, accounting for only eight percent of all sales. This development gave a clear signal to the industry that conventional supply sources were limited in the spot and near-term markets. Almost 80 percent of material was sold by US entities, 16 percent by European entities, and two percent by Canadian.

Long-Term Sales

The long-term uranium market was also extremely active in the first half of 1990, registering a total sales volume of approximately 40 million pounds equivalent U₃O₈ in 26 sales. This already exceeds all of 1989's volume of 35 million pounds. Most of the 1990 sales involved concentrates; four were UF₆, and one EUP.

Producers sold more than three-fourths of the long-term material, followed by intermediaries. Twenty-three of the 26 buyers were utilities.

Transaction Value

The Transaction Value (TV), which began the year at \$9.40 per pound equivalent U₃O₈, steadily decreased through May 31, falling below the EV during March, April, May, and June. The Transaction Value is designed as a lagging indicator, so this kind of behavior is typical when there is a change in market direction. Additionally, in this case the differences between the Transaction Value and the EV were accentuated by the inclusion in the TV

calculations of many UF₆ sales. At the end of June, the TV turned upward to \$8.80, giving its first evidence of the market turnaround.

Loans

Heavy borrowing took place during the first six months of 1990; NUEXCO reported 24 loans totalling over 9 million pounds equivalent U₃O₈. In comparison, a total of only 8.8 million pounds were loaned in all of 1989, and only 2.0 million in 1988. The Loan Rate remained at 3.5 percent, unchanged since November 30, 1987.

As in the past, utilities supplied the largest share (48 percent) of the loaned material, followed by producers at 34 percent; fabricators accounted for the remainder. Intermediaries were overwhelmingly the largest borrowing group, taking 89 percent of all material. Two utilities borrowed approximately one million pounds total.

Conversion

Twelve conversion sales are reported this year to date for a total of about 3.6 million pounds U as UF₆. Intermediaries were sellers in seven of the sales, while all twelve purchasers were utilities. The Conversion Value declined slowly but steadily between December 31, 1989 and June 30, 1990, beginning at \$1.65, falling to \$1.50 the next two months, and then declining to \$1.45 for the next three months.

Enrichment

Activity in the enrichment services market was unusually high for the first half of 1990—22 transactions are reported totalling approximately 3.8 million SWU. In contrast, a total of 18 transactions were reported in 1989 totalling 1.8 million SWU. The NUEXCO SWU Value fell \$4 on February 28, 1990, from \$54 to \$50 per SWU, and has remained at that level since then.

One large long-term sale between a European producer and a Far Eastern utility accounted for about 44 percent of this year's volume. Intermediaries sold the next greatest volume (almost 1.5 million SWU), followed by utilities (400 thousand), and fabricators (100 thousand). Utilities purchased almost 89 percent of all enrichment services, while intermediaries and one fabricator accounted for the difference. ■

WORLD URANIUM REQUIREMENTS 1990-2005

The following article is a review of the uranium requirements section of the 1990 NUEXCO Market Analysis and Price Trend Projections for Nuclear Fuel Materials and Services. It provides a summary of the forecast of worldwide uranium requirements for 1990-2005. Detailed forecast scenarios are contained in the complete report and are available from NUEXCO Information Services.

Overview

NUEXCO's projection for uranium requirements falls somewhat lower this year than in the past. Several factors affected this year's forecast, including more efficient uranium utilization designs and higher batch discharge burnups, the cutback of the United Kingdom's nuclear reactor construction plans to only one unit, evolving inventory policies, and changing enrichment requirements. The effect of these factors has been more accurately assessed because NUEXCO's calculation model has been enhanced since last year to better track the annual changes in requirements. The uranium requirements projection is based upon NUEXCO's projection of installed nuclear generating capacity and anticipated capacity factors for those units. An expected growth rate of 1.4 percent per annum from 1990 through the year 2000 leads to cumulative world uranium requirements for 1990-2005 of 2.2 billion pounds equivalent U_3O_8 . The average is almost 138 million pounds per year.

The full NUEXCO report examines different scenarios incorporating varying degrees of optimism or pessimism with regard to: cancellation of partially completed, but presently halted reactors; completion dates of reactors actively under construction; and the construction start and completion dates of planned reactors. For example, the high growth case projects the completion of all halted reactors, and the completion of more new reactors than currently scheduled. The low growth case however, assumes the cancellation of all halted reactors, major slippage of completion dates on reactors under construction, and no completion of presently unplanned

reactors after 2000. The reference case is used throughout the article. It assumes some slippage of construction schedules, and the cancellation of most reactors whose construction is indefinitely halted. It also assumes that the late 1990s growth rate of nuclear programs will continue during the early post-2000 time frame.

Methodology

The term "requirements," as used by NUEXCO, refers to the amount of natural uranium in the form of concentrates that must be delivered to a conversion facility in order to begin preparation of fuel assemblies based on normal lead times. For an initial core load, NUEXCO assumes a 30-month lead time prior to the Commercial Operation Date (COD) of a reactor. Reload calculations use an 18-month lead time. The amount of uranium is expressed in million pounds U_3O_8 .

Calculations are based on five principal factors affecting uranium requirements:

- Nuclear electric generating capacity in operation as well as annual additions.
- Nuclear plant design characteristics:
 - Operating life
 - Core loading
 - Thermal efficiency
- Nuclear plant operating characteristics:
 - Capacity factor
 - Cycle length
- Nuclear fuel characteristics:
 - Fuel assembly design
 - Initial core enrichment and burnup
 - Reload fuel enrichment and burnup
- Fuel cycle characteristics:
 - Enriching tails assay
 - Recycle of uranium
 - Recycle of plutonium
 - Fuel preparation lead times
 - Fuel processing losses

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Table 1
URANIUM REQUIREMENTS AND GROWTH RATE BY REGION

Region	Requirements (Million Pounds Equivalent U ₃ O ₈)			Growth Rate (Percent per Year) 1990-2000
	1990	2000	2005	
Europe	52	56	67	0.9
Far East	21	31	36	3.8
Other Countries ¹	7	10	12	3.4
USA	42	43	44	0.3
Total	122	140	159	1.4²

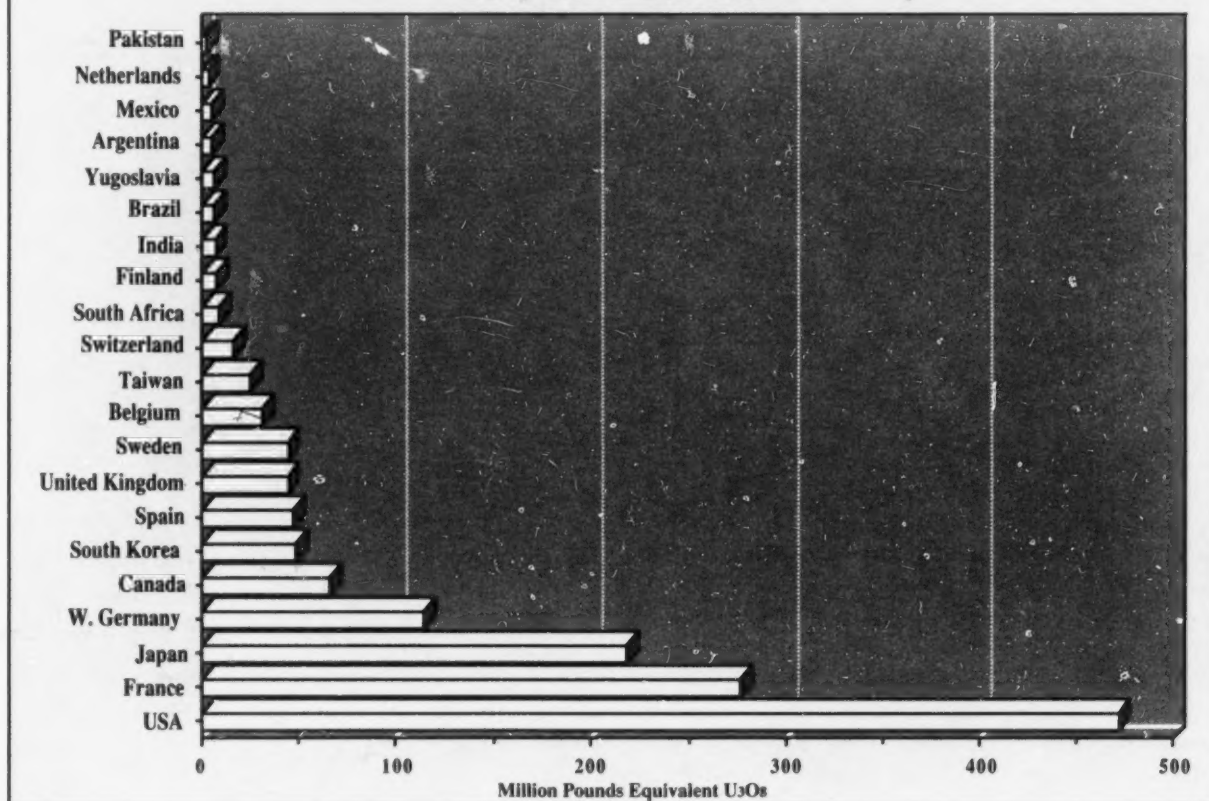
¹ Other Countries: Argentina, Brazil, Canada, India, Mexico, Pakistan, and South Africa

² Weighted average by region

Regional Requirements

Seventy-five percent of the total natural uranium requirements of the nations included in this study will be needed by four countries: the USA, France, Japan, and West Germany. The average growth rate for uranium requirements is forecast at 1.4 percent per year. European and US uranium requirements will grow at rates of less than one percent annually, while the Far East's and other countries' requirements will grow at a rate of over three percent per

Figure 1
CUMULATIVE URANIUM REQUIREMENTS
BY COUNTRY 1990 - 2000



ANALYSIS AND COMMENTARY

year. **Table 1** shows the projected requirements for each region for the years 1990, 2000, 2005, and the average annual growth rate expected this decade for each region.

The uranium requirements are based upon the reference growth case for installed nuclear capacity and projected capacity factor. In addition, the requirements estimates exclude any reductions due to the usage of inventory material or any recycling programs. Those materials are considered supplementary feed. **Figure 1** shows the cumulative uranium requirements by country for the years 1990-2000.

Nuclear Electric Generating Capacity

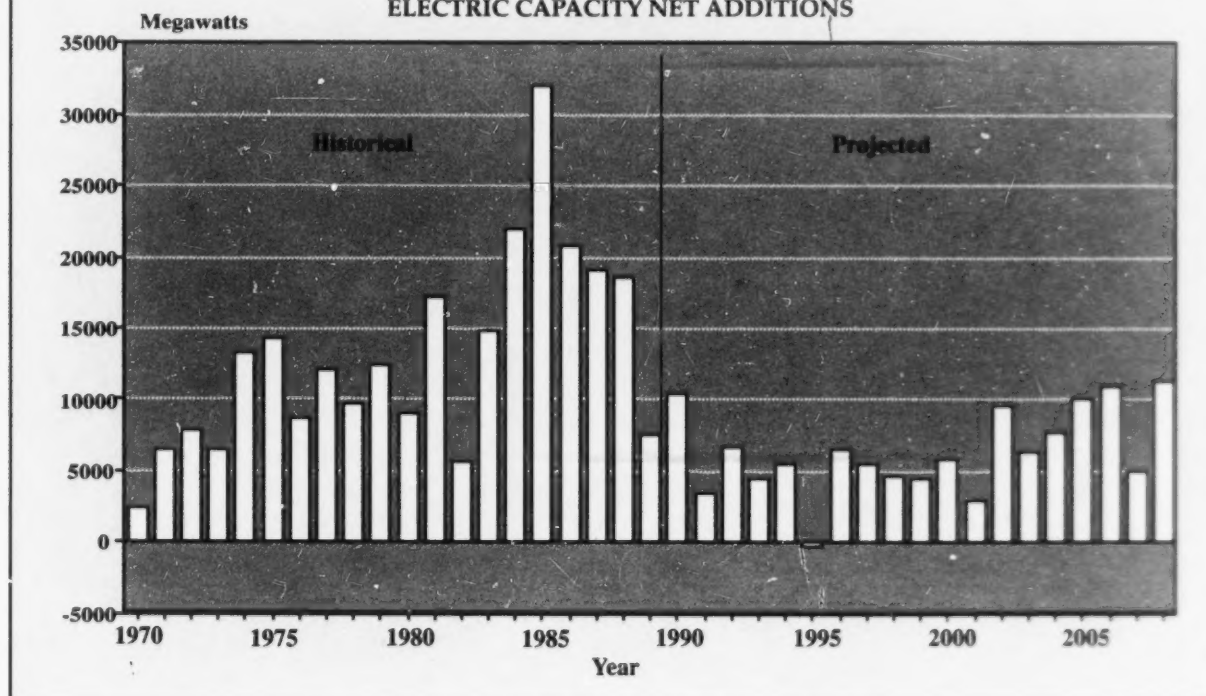
NUEXCO's projection of installed nuclear electric generating capacity for the reference case shows a growth

Table 2
INSTALLED NUCLEAR ELECTRICAL CAPACITY
AND GROWTH RATE BY REGION

Region	Capacity (GWe)		Growth 1989-2000		
	1989	2000	GWe	Percent	Percent/year
Europe	116	129	13	11	1.0
Far East	40	67	26	65	4.5
Other Countries	17	28	10	61	4.4
United States	96	103	7	7	0.6
Total	269	326	57	21	1.8

in installed capacity to 326 gigawatts (GWe) in the year 2000. **Table 2** shows the breakdown of installed capacity and growth rate by region. This represents a 1.8-percent average annual growth rate during the 11-year period of 1990 through 2000. This compares to the 10.4-percent average annual growth rate of capacity for the period

Figure 2
HISTORICAL AND PROJECTED NUCLEAR
ELECTRIC CAPACITY NET ADDITIONS



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Table 3
FACTORS CONSIDERED IN
CAPACITY PROJECTIONS

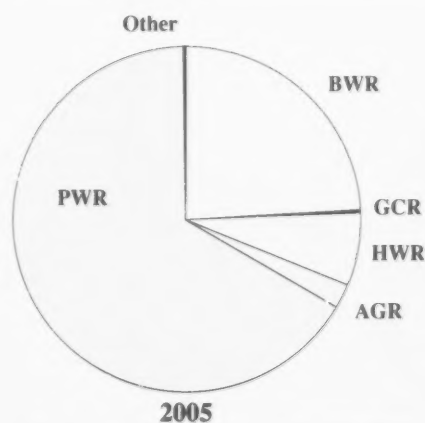
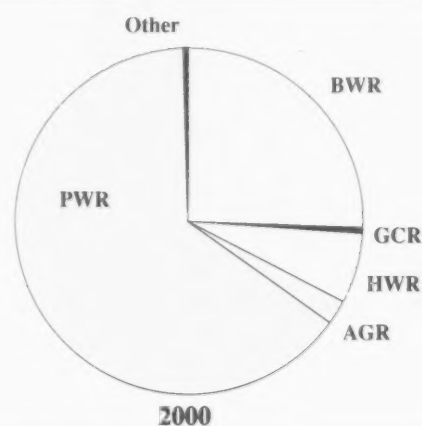
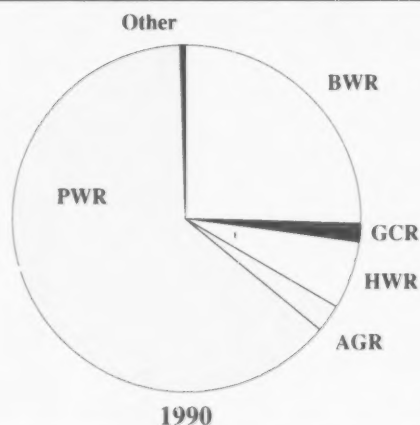
- Electricity demand growth rates
- Political and societal environments
- Financial resources of operating entities
- National energy plans
- National construction experience
- Specific construction plans and schedules
- Current status and construction progress
- Construction management expertise
- Licensing progress and/or backlog
- Public acceptance of nuclear power
- Projected plant lifetimes
- Public utility regulatory considerations

1978–1989. **Figure 2** displays a bar chart of net annual additions to installed capacity from 1970 to 1989, and projected additions through 2008. This graph vividly shows the reduced growth rate of capacity additions.

In the preparation of these projections, NUEXCO examined the civilian reactor program within each country. The study estimated reactor CODs, retirements (reactor life is assumed to be 40 years unless other plans were announced), completion of planned units, and cancellations. This information, along with the factors listed in **Table 3**, led to the capacity forecasts and subsequent uranium requirements projection.

Figure 3 gives a breakdown of projected installed capacity for 1990, 2000, and 2005 by reactor type. Boiling Water Reactors (BWR) maintain about a 25-percent share of generating capacity throughout the analyzed time period. Gas Cooled Reactors (GCR), Advanced Gas Reactors (AGR), and other reactor types decline in share over the same period. Heavy Water Reactors (HWR) remain at just over six percent during the span of the projection. Pressurized Water Reactors (PWR) contribute the largest share of capacity in 1990, growing from 63 percent to over 66 percent by 2005.

Figure 3
PROJECTED INSTALLED CAPACITY
BY REACTOR TYPE



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Table 4
AGGREGATE CAPACITY FACTOR
BY REGION

Region	1987-1989 (percent)	2000 projection (percent)
Europe	67.4	72.0
Far East	73.7	76.5
Other Countries	67.3	69.8
USA	63.8	69.2
Total	67.0	71.8

Nuclear Plant Operating Characteristics

Reactor capacity factors (CF) directly affect the uranium requirements calculation. The CF of a specific reactor is defined as the ratio of actual electrical production over a period of time to the theoretical maximum production that could have been obtained had the reactor operated at full power for 100 percent of the time. For each reactor operating during 1987-1989, the analysis uses the average of those three years for that reactor's 1990 CF. For reactors completed after 1987, the projection uses the average capacity factor for that type of reactor as its 1990 capacity factor estimate. To allow for reasonable future improvements at a plant, the analysis assumes that the CF will increase gradually each year as a ramp function toward a maximum feasible capacity factor for that reactor type. This improvement function depends on the specific characteristics of the reactor such as whether it refuels on-line or shuts down for refueling. **Table 4** gives the aggregated average capacity factor for 1987-1989 by region. The table also provides a projection of aggregate CF for each region for the year 2000.

The cycle length also affects uranium requirements. A substantial trend toward longer operating cycles has developed in the USA, but to a much lesser extent elsewhere in the world. Thus, NUEXCO's US projections take into account the effect of longer cycle lengths. Increases in cycle length result in higher fuel costs, but may be offset by a reduction in downtime. Since longer cycles theoretically result in less downtime for fuel

reloads, plant capacity factors generally should be improved. In addition, longer cycle lengths tend to increase uranium requirements slightly per unit of energy production.

Fuel Cycle Characteristics

In the 1980s, two technological developments emerged in LWR fuel fabrication that will significantly affect future requirements—improved uranium utilization designs and higher batch average discharge burnups. Since only a quarter, or at most one half, of the core is replaced during a refueling, it requires three to six years to realize the full benefits of improved uranium utilization. Improvements vary by reactor type and by how soon a country begins to incorporate the new designs in its energy plans. Sweden, West Germany, and the USA already have begun using the improved designs.

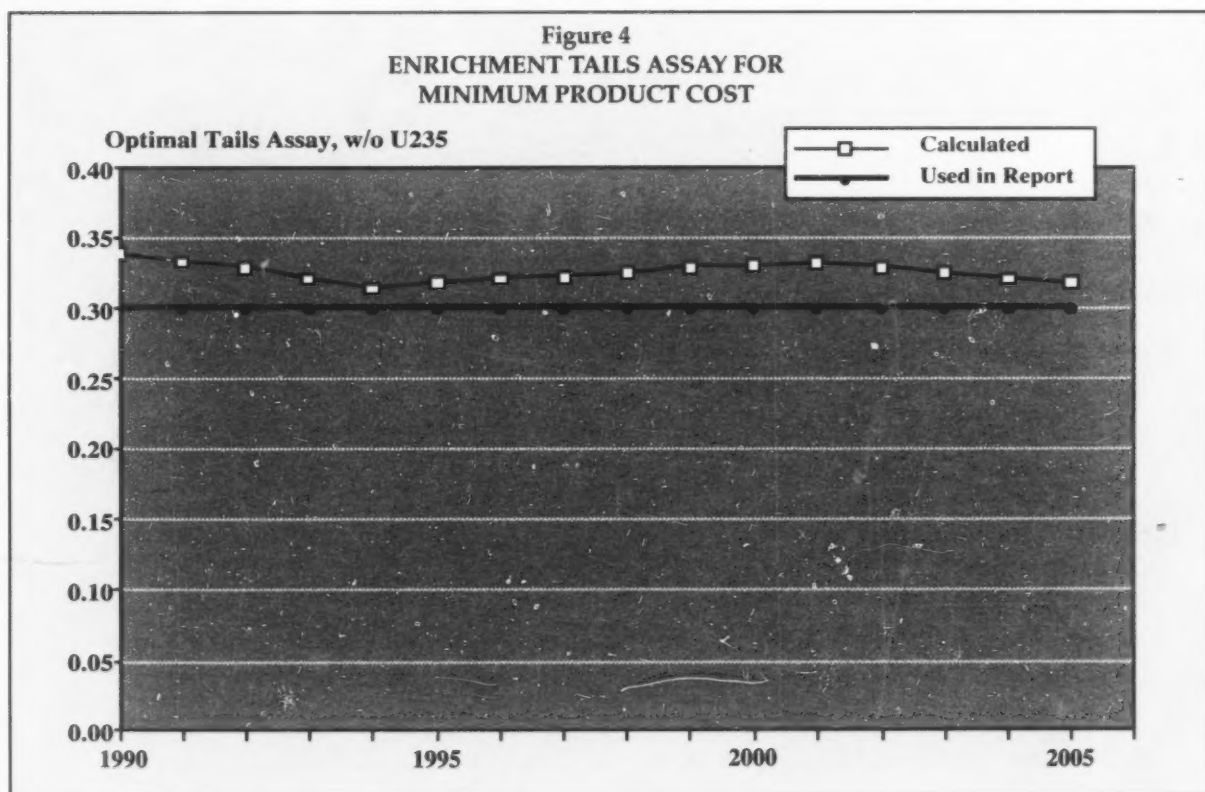
Given the projected rate of implementation of the improved designs, uranium utilization by BWRs may improve by nine percent by 2000; concurrently, utilization by PWRs may improve by five percent by the end of the decade. The study's uranium requirements projection allows for this reduction of requirements. It also takes into consideration improved discharge burnups resulting from improved designs and changing fuel cycle policies by some utilities. Although not expected, fuel failures arising from the new designs could delay the acceptance of the designs, and thus would tend to increase uranium requirements. While present fuel failure rates are negligible at less than one percent, NUEXCO's requirements projections take into account the potential risk of fuel failures that may occur when the new designs are fully implemented (post-1995).

Enrichment tails assays also significantly influence uranium requirements. The higher the tails assay, the more uranium feed is required. As a rough estimate, a tails assay change of 0.01 percentage points (such as 0.25 to 0.26 percent) changes the feed requirements by about two percent. For the time period of the study, the optimal enrichment tails assay was calculated to provide the minimum product cost based upon the projected uranium spot price and SWU contract price for each year. During

ANALYSIS AND COMMENTARY

the years of the study period, the optimal tails assay exceeded 0.3 weight percent (w/o) U^{235} . However, most enrichers use an upper limit of 0.3w/o; thus, if a calculated tails assay exceeded 0.3w/o, the projections use 0.3w/o for that year. **Figure 4** shows the calculated optimal tails assay each year through 2005. As can be seen from the

graph, the report used 0.3w/o throughout the period of the study. If the AVLIS or other laser-based enrichment processes are successfully deployed on a large scale in the latter 1990s, the tails assay projection would be too high, and actual uranium requirements for the future would be reduced. ■



CALENDAR

NUCLEAR INDUSTRY CALENDAR

1990

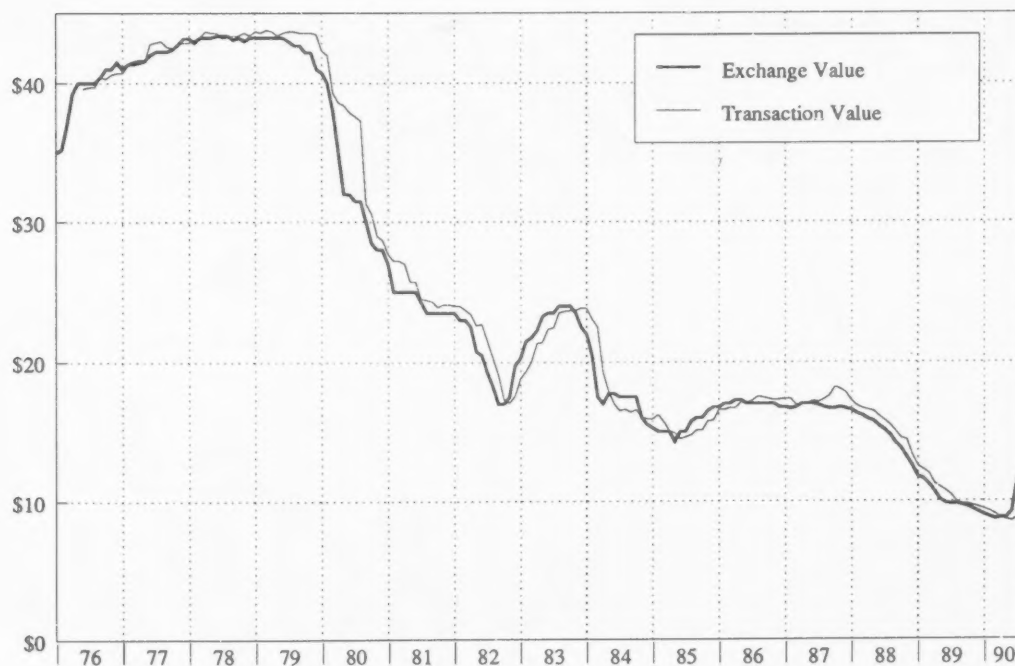
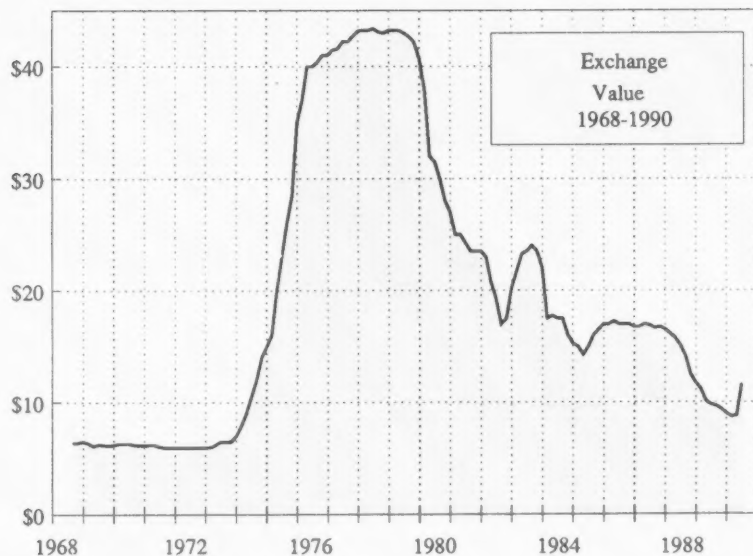
- Sept. 4-7** *International Seminar on the Costs and Financing of Nuclear Power in Developing Countries* (Jakarta, Indonesia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.
- Sept. 5-7** *Uranium Institute 15th Annual Symposium* (London, England). Contact the UI at 44-1-225-0308.
- Sept. 13** *The New Currency: How to Capitalize on Air Emissions Credits* (Watergate Hotel, Washington, DC), sponsored by The Energy Daily. Contact Lissa Wilson at 1-202-662-9728.
- Sept. 16-19** *Uranium Seminar '90* (Hyatt Regency, San Antonio, Texas), sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.
- Sept. 23-26** *AMC Mining Convention* (New Orleans, Louisiana). Contact American Mining Congress, Suite 300, 1920 N Street N.W., Washington, D.C. 20036, or facsimile 1-202-861-7535.
- Sept. 23-28** *ENC '90 Congress & Exhibition* (Lyon, France) organized by the European Nuclear Society in collaboration with the ANS and Foratom. Contact Dr. P. Feuz, European Nuclear Society at 31-21 61 11.
- Oct. 14-16** *World Nuclear Fuel Market Annual Meeting* (Toulouse, France). Contact Donna Cason at 1-404-447-1144.
- Nov. 11-14** *Nuclear Energy Forum* (Washington Hilton, Washington, D.C.), sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611.
- Nov. 12-16** *First Regional Seminar for Europe and the Middle East on Quality Management for Nuclear Power Projects* (Prague, Czechoslovakia), sponsored by the International Atomic Energy Agency. Contact Conference Service Section, IAEA P.O. Box 100, A-1400 Vienna, Austria.

1991

- April 14-18** *Third International Conference on Nuclear Fuel Reprocessing & Waste Management* (Sendai, Japan), sponsored by the Atomic Energy Society of Japan and the Japan Atomic Industrial Forum, co-sponsored by the American Nuclear Society and the European Nuclear Society. Contact the Japan Atomic Industrial Forum at telephone 3-508-2411, or facsimile 3-508-2094.
- May** *Second International Conference on Transportation for the Nuclear Industry* (Bournemouth, England). Contact the Conference Secretary, The Institution of Nuclear Engineers, at 081-698 1500.

HISTORICAL MARKET DATA

**NUEXCO Historical
Exchange Value and
Transaction Value**
 (In US Dollars per Pound Equivalent U₃O₈)



HISTORICAL MARKET DATA

HISTORICAL MARKET VALUES

EXCHANGE VALUES												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85	8.70	8.80	8.80	9.25	11.60						

US PREMIUM (Relative to the Exchange Value)												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	Discontinued	

HISTORICAL MARKET DATA

UF6 VALUES Determined as of the last day of the month indicated (\$US/kg U as UF6)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90	25.25	24.40	24.40	25.50	32.00						

US UF6 PREMIUM (Relative to the UF6 Value) Determined as of the last day of the month indicated (\$US/kg U as UF6)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	Discontinued	

TRANSACTION VALUES Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25	9.05	8.75	8.65	8.55	8.80						



HISTORICAL MARKET DATA

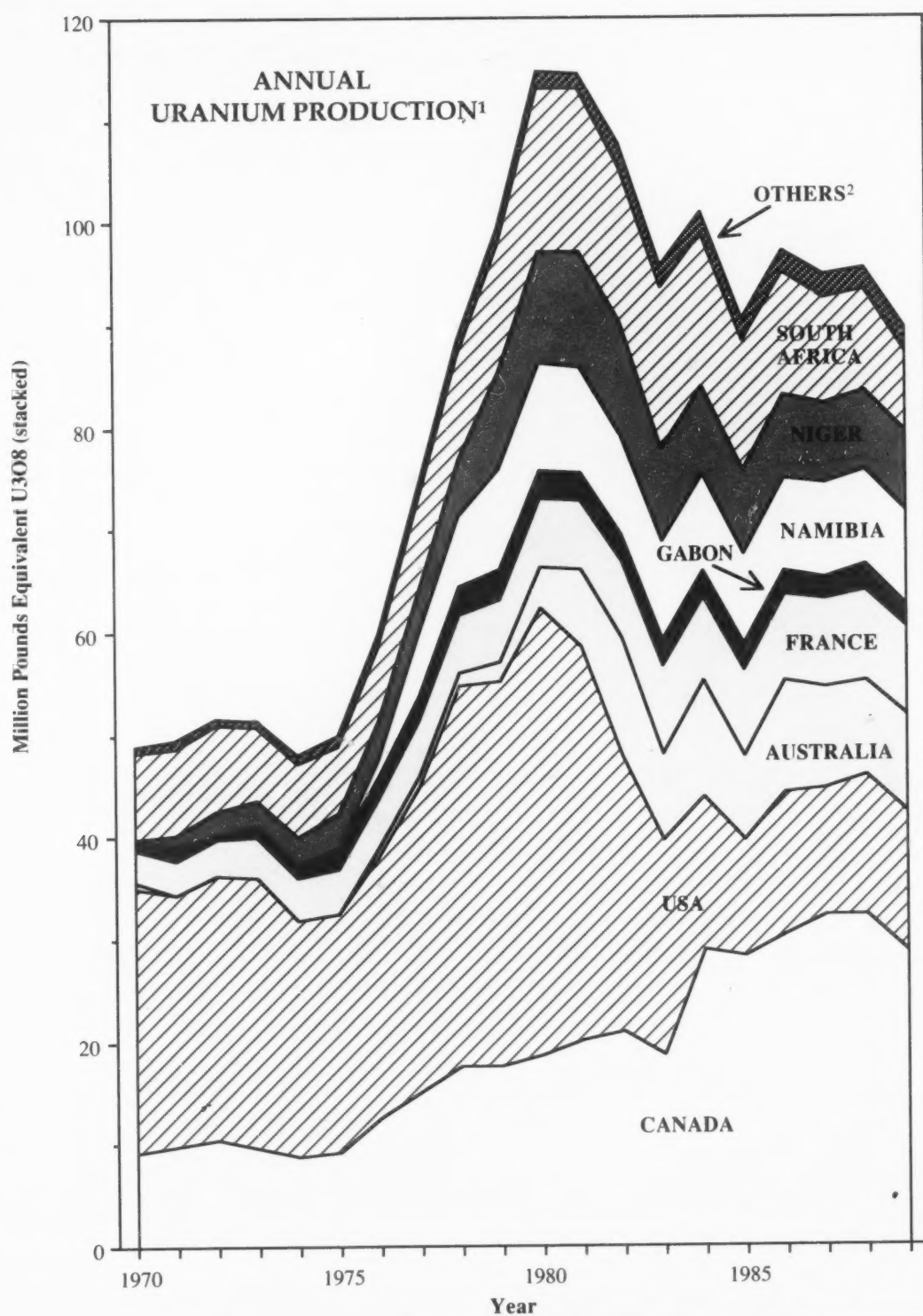
LOAN RATES												
Determined as of the last day of the month indicated (Percent per Annum)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50	3.50	3.50	3.50	3.50	3.50	3.50					
* Float with Prime Rate												

* Float with Prime Rate

CONVERSION VALUES												
Determined as of the last day of the month indicated (\$US/lb U as UF6)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.50	1.50	1.45	1.45	1.45	1.45						

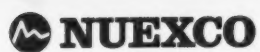
SWU VALUES												
Determined as of the last day of the month indicated (\$US per SWU)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54	50	50	50	50	50						

HISTORICAL MARKET DATA

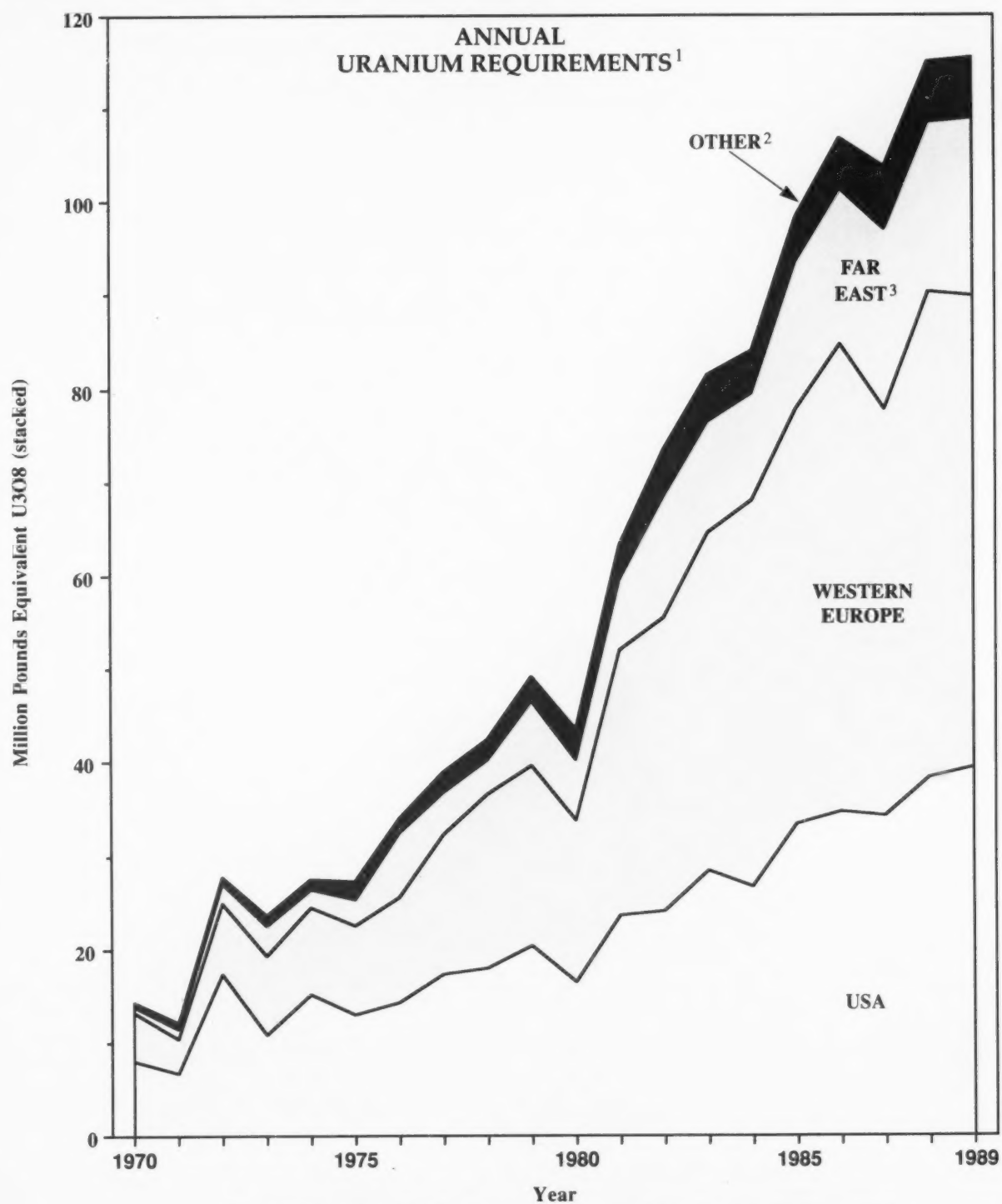


¹ Estimated world production in 1989 totalled 89.6 million pounds (Australia—9.5; Canada—28.7; France—8.5; Gabon—2.2; Namibia—9.2; Niger—7.7; South Africa—7.7; USA—13.7; Others²—2.3).

² Others includes: Argentina, Belgium, Brazil, India, Pakistan, Portugal, Spain, West Germany and Yugoslavia



HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

² Other include: Argentina, Brazil, Canada, India, Mexico, Pakistan and South Africa.

³ Does not include Peoples Republic of China.

HISTORICAL MARKET DATA

AUSTRALIA					
Year	Period ¹	Consumer Price Index ² (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ³ (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia ⁴ (Australian dollars)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates ⁵ (June 1985=100)
1980	Avg.	95.8	83.1	—	140.8 ⁶
1981	Avg.	105.0	85.9	—	154.1 ⁶
1982	Avg.	116.7	89.0	—	174.9 ⁶
1983	Avg.	128.5	96.9	—	181.9 ⁶
1984	Avg.	133.6	98.0	—	194.4 ⁶
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
1989	Avg.	194.6	117.0	534.65	—
Jan	1989	—	110.6	—	122.2
Feb	1989	—	111.2	521.90	122.2
Mar	1989	188.0	114.9	—	123.1
Apr	1989	—	117.5	—	125.4R
May	1989	—	118.6	530.40	125.6R
June	1989	192.6	119.9	—	125.8R
July	1989	—	120.1	—	126.9R
Aug	1989	—	119.2	539.30	127.0R
Sept	1989	197.0	117.7	—	127.1R
Oct	1989	—	117.8	—	127.3R
Nov	1989	—	118.0	547.00R	127.6R
Dec	1989	200.7	118.2	—	128.0R
Jan	1990	—	119.2	—	128.0R
Feb	1990	—	120.8	—	128.0R
Mar	1990	204.1	121.5	—	128.2
Apr	1990	—	119.9	—	128.5

P = Preliminary R = Revised since last month

¹ Monthly data for the period 1967 to 1986 appears in Report 233 (January 1988).

² Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 = 100.0). Figures shown at end of quarter represent quarterly average.

³ Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

⁴ Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

⁵ Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

⁶ Base: June 1976 = 100.

GOVERNMENT STATISTICS

CANADA								
Wage-earner Data: Average Hourly Earnings (C\$) ²								
		Industrial Products Price Index: All Commodities ¹ (1981 = 100)	Consumer Price Index: All Items (1981 = 100)	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells ³ (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	90.7	88.9	—	—	—	—	—
1981	Avg.	100.0	100.0	—	—	—	—	—
1982	Avg.	106.7	110.8	—	—	—	—	—
1983	Avg.	110.4	117.2	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	122.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	127.2	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	132.4	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	138.2	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	143.8	20.91	18.51	16.95	13.17	13.77
1989	Avg.	131.1R	151.0	21.97	20.02	18.41	13.71	14.16
Jan	1989	130.7	146.8	21.22	19.45	18.14	13.75	13.82
Feb	1989	130.8	147.8	22.05	19.51	18.26	13.79	13.89
Mar	1989	131.3	148.5	21.90	19.65	18.35	13.62	14.10
Apr	1989	131.3	149.0	22.37	19.80	18.40	13.57	14.16
May	1989	131.4	150.5	21.89	20.02	18.17	13.76	14.27
June	1989	131.5	151.3	21.89	20.02	18.17	13.76	13.22
July	1989	131.4	152.3	21.67	19.60	17.96	13.57	12.98
Aug	1989	131.3	152.4	20.97	19.76	18.24	13.52	14.30
Sept	1989	131.0	152.6	21.97	20.61	18.73	13.68	14.83
Oct	1989	130.8	153.2	22.26	20.71	18.74	13.99	14.77
Nov	1989	130.8R	153.7	22.60	20.64	18.78	13.93	14.75
Dec	1989	130.4R	153.6	22.80	20.50	18.93	13.62	14.77
Jan	1990	130.7R	154.9	21.88	20.39	19.03	13.99	14.78
Feb	1990	131.6R	155.8	22.51	20.63	19.14	14.49	15.03
Mar	1990	131.4R	156.3	22.52	20.75R	19.17	14.99R	15.07R
Apr	1990	131.4	156.4	23.15P	20.81P	19.28P	14.71P	14.99P
May	1990	131.8	157.2	—	—	—	—	—

P = Preliminary R = Revised since last month

¹Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

²Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

³Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)."

GOVERNMENT STATISTICS

SOUTH AFRICA							
		Average Declared Working Costs per Metric Ton of Gold Ore Milled ¹ (Rand)	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled ² (March 1982 = 100)	Consumer Price Index ³ (1985 = 100)	Production Price Index All Groups ⁴ (1985 = 100)	Total Employment in Mining and Quarrying ⁵	Total Salaries and Wages in Mining and Quarrying ⁵ (1,000 Rand)
							Annual Total ⁶
1980	Avg.	35.53	—	51.9	55.2	709,042	2,237,689
1981	Avg.	41.89	—	59.8	62.7	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	71.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	79.0	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	85.6	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	100.0	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	119.5	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	136.2	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	154.1	705,355	7,774,054
1989	Avg.	116.65	273.0	178.2	177.5	700,360	8,833,934R
							Monthly Total
Jan	1989	—	—	166.8	165.5	714,593	704,320
Feb	1989	—	—	168.2	168.5	696,329	669,983
Mar	1989	112.29	262.8	170.9	171.1	702,746	695,843
Apr	1989	—	—	173.1	173.8	658,677	634,344
May	1989	—	—	175.9	176.4	706,056	721,263
June	1989	113.76	267.0	177.7	177.1	706,810	720,586
July	1989	—	—	179.3	178.8	711,648	775,002
Aug	1989	—	—	181.8	180.7	703,812	793,475
Sept	1989	119.76	280.2	183.4	181.7	708,222	780,723
Oct	1989	—	—	185.1	183.9	689,017	737,718R
Nov	1989	—	—	187.0	185.6	704,025	790,375
Dec	1989	120.79	282.0	189.4	187.2	702,332	810,302
Jan	1990	—	—	192.0	188.8	688,837	801,616
Feb	1990	—	—	193.3	190.3	674,026	767,274
Mar	1990	126.74	296.3	196.4	190.9	—	—
Apr	1990	—	—	198.3	194.0	—	—
May	1990	—	—	200.4	—	—	—

P = Preliminary R = Revised since last month

¹Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

²Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

³Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 236.

⁴Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

⁵Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

⁶Annual total is shown, rather than monthly average for indicated year.

GOVERNMENT STATISTICS

UNITED STATES									
		Producer Price Index ¹		Consumer Price Index ²	GNP Implicit Price Deflator ³	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
1989	Avg.	111.6	112.2	124.0	126.6	13.67	13.75	13.06	10.38
Jan	1989	109.4	110.5	121.1	—	13.80	13.49	12.85	10.27
Feb	1989	110.1	110.8	121.6	—	13.66	13.48	12.88	10.26
Mar	1989	110.5	111.5	122.3	125.4	13.71	13.51	12.91	10.30
Apr	1989	111.8	112.3	123.1	—	13.68	13.65	12.92	10.31
May	1989	112.1	113.2	123.8	—	13.60	13.57	12.98	10.33
June	1989	112.4	112.9	124.1	126.0	13.62	13.66	12.98	10.37
July	1989	112.2	112.8	124.4	—	13.70	13.75	13.12	10.41
Aug	1989	111.4	112.0	124.6	—	13.64	13.72	13.08	10.40
Sept	1989	111.9	112.4	125.0	126.8	13.70	13.99	13.18	10.47
Oct	1989	112.4	112.8	125.6	—	13.76	13.94	13.25	10.43
Nov	1989	112.2	112.7	125.9	—	13.69	14.12	13.26	10.47
Dec	1989	112.3	113.0	126.1	128.0	13.51	14.16	13.31	10.52
Jan	1990	114.1R	114.9	127.4	—	13.75	13.95	13.31	10.50
Feb	1990	113.6	114.4	128.0	—	13.75	13.98	13.24*	10.54
Mar	1990	113.2	114.2	128.7	129.7	13.85R	14.04R	13.30R	10.58
Apr	1990	113.1	114.0	128.9	—	14.06P	14.33P	13.45R	10.58
May	1990	113.3	114.5	129.2	—	—	—	13.45P	10.67P

P = Preliminary R = Revised since last month

¹US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

²US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

³US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

⁴US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

GOVERNMENT STATISTICS

**VOLUME AND PRICE OF URANIUM DELIVERIES
TO THE EUROPEAN COMMUNITY¹**
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC ² (MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ³ Average Price		Spot Contracts ³ Average Price	
			in ECU per pound U ₃ O ₈	in US Dollars per pound U ₃ O ₈	in ECU per pound U ₃ O ₈	in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,560	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65	\$16.13
1989	13,500	11.5	ECU 26.63	\$29.35	ECU 11.04	\$12.19

R = Revised

¹ The twelve European Community member nations are Belgium, Denmark, France, West Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

² The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³ For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar. Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.



GOVERNMENT STATISTICS

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	\$16.10	3.6	n/a	1.2
1977	29.9	27.8	\$19.75	5.6	n/a	4.0
1978	37.0	31.6	\$21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agents

³ Includes imports by domestic utilities and domestic suppliers

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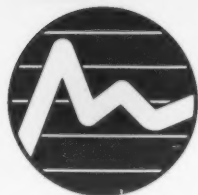
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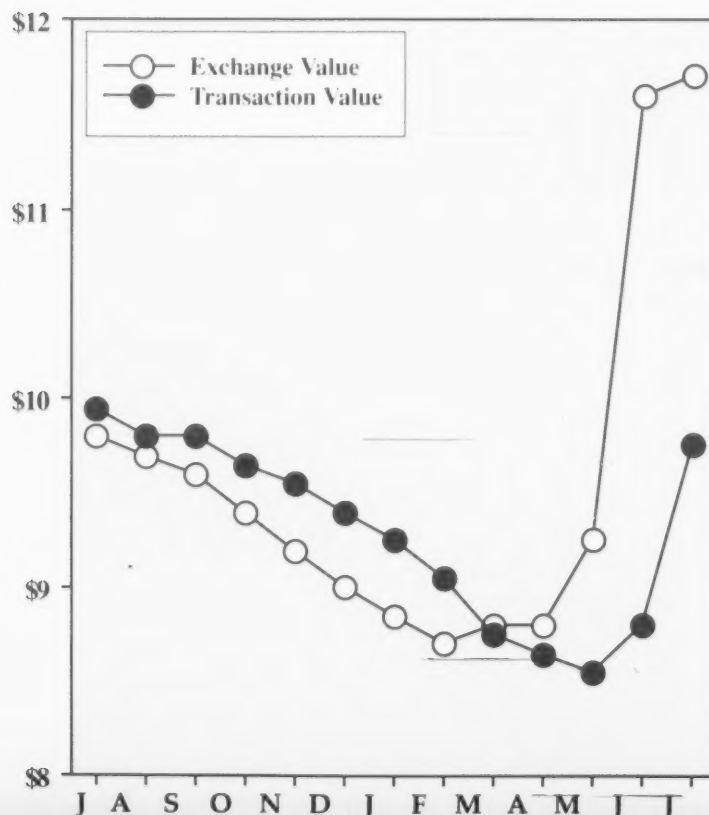


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• World Enrichment Services Market (1990-2005)

NUEXCO projects cumulative world enrichment requirements to exceed 285 million SWU through the year 2000. Unfilled requirements, particularly in the USA, will rise in the second half of the 1990s, but the oversupply of enrichment capacity will continue to grow. Suppliers will compete aggressively to capture the available demand.

• South Africa Update 27

This update presents some of the developments that occurred during the first half of 1990, including first half 1990 uranium production figures, mining privatization bill progress, and of the status of anti-apartheid sanctions.

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• US Uranium Exploration and Development Update

As a result of the US uranium industry's deterioration in the last decade, little exploration and development drilling is taking place. Nevertheless, the continuation of drilling activity provides hope for the industry's eventual recovery.

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To Our Readers

NUEXCO is pleased to announce that **Melanie R. Bizal** has joined the organization effective July 9, 1990. Melanie holds a MS in Mineral Economics and a BS in Petroleum Engineering from Colorado School of Mines. She joins us from Ensign Oil and Gas where she was responsible for reservoir engineering projects such as development drilling and well enhancement, and secondary and tertiary recovery. She also had responsibility as Ensign's natural gas coordinator. Previous to her work at Ensign, she was a petroleum engineer for Northern Pump Company.

Melanie will remain in Denver and work for NUEXCO Information Services as a Uranium Supply Analyst.



NUEXCO's International Advisory Committee recently met in Finland and the Soviet Union. One of the most interesting examples of their hosts' hospitality was a tour of a Soviet enrichment facility. The photo shows members of the committee and some of their hosts outside the administrative building of the Soviet enrichment facility at Angarsk. The tour also included a fabrication plant and other fuel cycle facilities.

MARKET REVIEW
MARKET VALUES SUMMARY

July 31, 1990

NUEXCO Market Values	This Report July 31, 1990	Last Report June 30, 1990	12 Months Ago July 31, 1989
EXCHANGE VALUE ¹	\$11.70/lb equivalent U ₃ O ₈	\$11.60	\$9.80
UF₆ VALUE ²	\$32.50/kg U as UF ₆	\$32.00	\$30.00
LOAN RATE ³	3.5% / annum	3.5%	3.5%
CONVERSION VALUE ⁴	\$1.45/lb U as UF ₆	\$1.45	\$1.95
SWU VALUE ⁵ (0.3 w/o tails assay)	\$50/SWU	\$50	\$66
TRANSACTION VALUE ⁶	\$9.75/lb equivalent U ₃ O ₈	\$8.80	\$9.95
Transactions	35	38	19
Months	3	3	3
Millions of Pounds	9.1	11.3	3.4

DEFINITIONS

¹ The **Exchange Value** is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

² The **UF₆ Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

³ The **Loan Rate** is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

⁴ The **Conversion Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

⁵ The **SWU Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

⁶ The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:

- Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
- At least ten transactions;
- Transactions involving a sum total of at least 2 million pounds equivalent U₃O₈.

DERIVATIONS AND COMMENTS

• All **Market Values** are expressed in terms of US\$.

• All **Market Values** are based on:

- Data from recently completed transactions.
- Data from pending transactions.
- Firm bids to buy or borrow, and firm offers to sell or lend.
- Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend.

• Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these **Market Values**.

• In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers.

• The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.

• For the **SWU Value**, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the NUEXCO **Exchange Value** and **Conversion Value** determined as of the same date.

• In calculating the **Transaction Value**, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future **Exchange Values** or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined.

• The sample time for the **Transaction Value** is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

MARKET REVIEW

JULY MARKET REVIEW

(as of July 31, 1990)

OVERVIEW

After June's hectic pace and record price increases, uranium market activity slowed appreciably during July. The Exchange Value and UF₆ Value both increased moderately, to \$11.70 per pound U₃O₈ and \$32.50 per KgU as UF₆, respectively, as 5.3 million pounds equivalent U₃O₈ changed hands in eleven transactions. The nine near-term and spot concentrates sales involved 2.6 million pounds equivalent U₃O₈. Two UF₆ transactions are also reported—one small spot sale, and one long-term sale for more than two million pounds equivalent U₃O₈. July's transactions bring the year-to-date, near-term uranium sales volume to over 25 million pounds equivalent U₃O₈ (Table 1), fast approaching the 1989 record of almost 33 million pounds.

The Loan Rate, Conversion Value, and SWU Value all remain unchanged from their June 30 levels. Three loans for nearly two million pounds equivalent U₃O₈, two conversion sales for over 700 thousand pounds U as UF₆, and two secondary enrichment sales for small quantities of SWU are reported this month.

NATURAL URANIUM AND CONVERSION

Near-term Market Activity

The July 31 Exchange Value rose \$0.10, to \$11.70 per pound U₃O₈. After June's record percentage price increases, market activity has subsided somewhat. Sales occurring earlier in the month reflected some continued strengthening of prices, while those occurring in the latter half of July tended to cluster around the July 31 Exchange Value, as demand was satisfied and seller competition increased. As expected, the May and June price increases have drawn additional supplies into the market. Furthermore, demand has decreased for several reasons—partially because of reduced producer buying activity, partially because of less discretionary buying, and partially due to the closing of 42 near-term natural uranium sales for 10.4 million pounds in May, June, and July.

July's nine near-term concentrates sales totalled 2.6 million pounds U₃O₈. All of the buyers and at least seven of the nine sellers are US-based companies, as US market participants continued to dominate uranium market activity. Unlike June, when producers were the primary buyers, utilities accounted for the preponderance (81%) of July's near-term concentrates purchases.

Table 1
NEAR-TERM URANIUM SALES SUMMARY

	July 1990		Year-to-Date	
	No. of Sales	Volume ¹	No. of Sales	Volume ¹
Concentrates	9	2.6	44	11.6
UF ₆	1	<0.1	26	9.4
EUP	0	0.0	9	4.2
Total	10	2.6	79	25.2

¹ Million Pounds Equivalent U₃O₈

The UF₆ Value climbed \$0.50, to \$32.50 per KgU as UF₆ after a month of little UF₆ market activity; just one spot sale is reported. A US intermediary purchased a small quantity of natural UF₆ from a US seller for spot delivery. In addition, one US utility is evaluating offers for a discretionary purchase of UF₆ for near-term delivery. Increasing supply and lack of demand may inhibit any major price increase.

MARKET REVIEW

Table 2
NEAR-TERM SUPPLY/DEMAND SUMMARY

	Active Supply ¹	Active Demand ¹
• Natural Uranium ² (thousand lbs equivalent U ₃ O ₈)	5,595	405
• Supply/Demand Ratio:	13.8	
• Loans (thousand lbs equivalent U ₃ O ₈)	8,235	0
• Conversion (thousand lbs U as UF ₆)	0	400
• SWU (thousand SWUs)	435	75

¹ Supply and demand tables in the current market data section of this Report provide details for each category.
² Includes concentrates and hexafluoride.

The **Transaction Value** increased for the second consecutive month, to **\$9.75** per pound U₃O₈, based on 35 transactions involving 9.1 million pounds equivalent U₃O₈ over a three-month period. This \$0.95 increase reflects the influence of the higher-priced transactions of the past two months, which now account for over half of the volume included in the weighted-average Transaction Value calculation. Despite this month's increase, the Transaction Value is still almost two dollars below the Exchange Value. This lagging is due to the inordinately large volume and low prices from May's transactions that still qualify for inclusion in the TV calculation. (In fact, even if no August transactions qualified for the August 31 Transaction Value calculation, the routine exclusion of May's transactions would cause the Transaction Value to rise almost one dollar.)

Active uranium supply moved upward slightly to 5.6 million pounds equivalent U₃O₈, while **active uranium demand** dropped almost 90 percent, to 405 thousand pounds (Table 2). The resultant **supply/demand ratio** of 13.8 is the highest such ratio

since November 30, 1988. This supply/demand imbalance is a direct result of recent market price increases and the large sales volume over the past five months. In addition, loan supply remains abundant, which effectively adds to the imbalance, and also makes it possible for buyers to defer demand if they desire.

* * *

Long-Term Natural Uranium Market Activity

Only one long-term uranium sale is reported this month. A US utility purchased more than two million pounds equivalent U₃O₈ in the form of UF₆ from an intermediary for delivery beginning in 1991.

* * *

The **Loan Rate** remained at 3.5 percent per annum. Three loans are reported this month. In a departure from traditional roles, the lenders were not utilities, but rather two intermediaries and a producer. The loans involved nearly two million pounds equivalent U₃O₈ for delivery this year and repayments during the period 1990-1995. One of the loans carries a slightly higher interest rate, while the other two occurred at levels near the July 31 Loan Rate. Loan supply remains plentiful with over 8.2 million pounds equivalent U₃O₈ available for loan.

* * *

The **Conversion Value** remained unchanged at **\$1.45** per pound U as UF₆. Two US utilities purchased over 700 thousand pounds U as UF₆ for delivery in 1990 and mid-1991. One sale was not an arms-length transaction, while the other occurred at a price level near the July 31 Conversion Value. The conversion market has firmed somewhat in the last couple of months, resisting the downward pressure brought about by the inequality between the UF₆ price level and the sum of the values of its component parts— concentrates and conversion. However, current demand for conversion is thin, and when demand does arise, sufficient supply emerges to satisfy it, even though suppliers are not competing aggressively.

MARKET REVIEW

**ENRICHMENT SERVICES AND
ENRICHED URANIUM PRODUCT**

The **SWU Value** marked its sixth consecutive month at **\$50** per SWU. Intermediaries sold small quantities of SWU to US utilities in the only two SWU transactions

reported this month. Both buyers required delivery in less than 180 days, and because of such timing, they were forced to pay prices above the current SWU Value. However, ample SWU supply is still available; furthermore, additional inventory material could enter the market before the end of the year. ■

Table 3
ENRICHMENT PRICES
(July 31, 1990)

Prices	This Month Report 264	Last Month Report 263	12 Months Ago Report 252
NUEXCO SWU Value (\$US per SWU)	50	50	66
US DOE SWU prices: (\$US per SWU)			
USEC	117.85 ¹	117.85 ¹	117.00 ²
AFC	153.00 ³	153.00 ³	153.00 ³
Requirements	157.00 ³	157.00 ³	157.00 ³
Incentive Price (IP1)	90.00 ⁴	90.00 ⁴	90.00 ⁴
Calculated worth of enriched UF₆⁵: (\$US per KgU as UF ₆)			
2.0 w/o U ₂₃₅	225	223	236
2.5 w/o U ₂₃₅	308	306	328
3.0 w/o U ₂₃₅	393	391	422
3.5 w/o U ₂₃₅	480	478	519
4.0 w/o U ₂₃₅	568	565	617
4.5 w/o U ₂₃₅	657	654	717

¹ Effective 10/1/89 to 9/30/90.

² Effective 10/1/87 to 9/30/89.

³ Effective since 10/1/84.

⁴ Effective 10/1/86 to 9/30/90, for up to 30% of annual requirements.

⁵ Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 w/o tails assay.

RECENT TRANSACTIONS

Uranium Sales

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U ₃ O ₈)	Price Within Percentage Range ² of Current Exchange or UF ₆ Value	Buyer	Seller	Remarks
4903	1990	301-600	98-102	Utility	Intermediary	
4906	1990	Less Than 50	R ³	Intermediary	R ³	UF ₆
4910	1990	50-100	98-102	Producer	Producer	
4911	1990	101-300	98-102	Utility	Intermediary	
4912	1990	101-300	90-97	Utility	Intermediary	
4915	1991	101-300	90-97	Intermediary	Intermediary	
4917	1991	301-600	98-102	Utility	Intermediary	
4919	1990	50-100	98-102	Intermediary	R ³	
4920	1990	301-600	98-102	Utility	R ³	
4921	1990	101-300	98-102	Utility	Intermediary	
4924	1991-1992	1,001-3,000	R ³	Utility	Intermediary	UF ₆

¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

² The ranges *Below 90*, *90-97*, *98-102*, *102-110*, *Above 110*, represent percentages (rounded to whole numbers) of the appropriate current Exchange Value or UF₆ Value. The endpoints of each range are included within that range.

³ The notation **R** means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

MARKET REVIEW

RECENT TRANSACTIONS

Natural Uranium Loans						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U3O8)	Price Within Percentage Range ² of Current Loan Rate	Borrower	Lender	Remarks
4904	1990	301-600	Over 110	R ³	Intermediary	
4914	1990	301-600	98-102	Intermediary	Intermediary	
4918	1990	601-1,000	98-102	Producer	Producer	
Conversion Sales						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U equivalent)	Price Within Percentage Range ² of Current Conversion Value	Buyer	Seller	Remarks
4905	1990	50-100	R ³	Utility	Utility	
4913	1991	601-1,000	98-102	Utility	Intermediary	
Enrichment Sales						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity ⁴ (thousand SWU)	Price Within Percentage Range ² of Current SWU Value ⁵	Buyer	Seller	Remarks
4922	1990	Less Than 50	Over 110	Utility	Intermediary	
4923	1990	Less Than 50	103-110	Utility	Intermediary	
¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information. ² The ranges <i>Below 90</i>, <i>90-97</i>, <i>98-102</i>, <i>102-110</i>, <i>Above 110</i>, represent percentages (rounded to whole numbers) of the appropriate current Market Value. The endpoints of each range are included within that range. ³ The notation R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality. ⁴ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 % tails assay. ⁵ Prices are usually normalized to 0.30% tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.						

MARKET REVIEW

Uranium Supply				
(July 31, 1990)				
NUEXCO Project Number	Quantity (Thousand Pounds equivalent U ₃ O ₈)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Available for Sale				
ACTIVE				
89-1180*	350	--	1990	
90-1078A	2,175	2,175 per year	1991-1993	UF ₆
90-7001	3,000	3,000 per year	1991-1995	
90-1183*	70	--	1990-1991	
Total	5,595			
INACTIVE				
	500			
Available for Loan				
ACTIVE				
88-1182	4,000	--	--	U ₃ O ₈ /UF ₆
90-1016	300	--	--	U ₃ O ₈
90-1033	1,270	--	--	UF ₆
90-1108	1,000	--	--	U ₃ O ₈
90-1110	250	--	--	U ₃ O ₈
90-1115	390	--	--	UF ₆
90-1173*	500	--	--	U ₃ O ₈
90-1180*	525	--	--	U ₃ O ₈
Total	8,235			
INACTIVE				
	1,000			
* New or revised since last month.				
¹ For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.				
² For delivery beyond one year, measured from the date of this Report.				
Active Projects reclassified as Inactive since last month: none				
Active Projects removed since last month: none.				



MARKET REVIEW

Uranium Demand				
(July 31, 1990)				
NUEXCO Project Number	Quantity (Thousand Pounds equivalent U ₃ O ₈)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Inquiries to Purchase:				
ACTIVE				
90-1100A	45	--	1991	UF ₆ e
90-1171	75	--	1990	U ₃ O ₈ /UF ₆
90-1177A*	260	--	1991	UF ₆ e
90-1182*	25	--	1991	
90-1098	--	250 per year	1992-1994	
90-1113	--	800	1991-1995	
90-1155	--	325 per year	1991-1995	
90-1170*	--	290	1992-1996	
Total	405			
INACTIVE	2,080			
Inquiries to Borrow	No inquiries to borrow are reported			
* New or revised since last month.				
¹ For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.				
² For delivery beyond one year, measured from the date of this Report.				
Active Projects reclassified as Inactive since last month: 90-1126, 90-1138.				
Active Projects removed since last month: 90-1146, 90-1149, 90-1151, 90-1154, 90-1156, 90-1161, 90-1163, 90-1166, 90-1167A.				

MARKET REVIEW

Conversion Supply and Demand

(July 31, 1990)

Quantity
(Thousand Pounds U as UF₆)

NUEXCO
Project Number

Within 3 Years ¹

Beyond 3 Years ¹

Remarks

Available for Sale

No offers to sell are reported

**Inquiries to Purchase
ACTIVE**

90-1184*

400

--

Total

400

INACTIVE

None reported

* New or revised since last month.

¹ Measured from the date of this Report.

Active Projects reclassified as Inactive since last month: *none*.

Active Projects removed since last month: 90-1167B, 90-1167C.



MARKET REVIEW

SWU Supply and Demand				
(July 31, 1990)				
NUEXCO Project Number	Quantity (Thousand SWUs)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Available for Sale				
ACTIVE				
90-1078B	435	435 per year	1991-1993	UF6e
90-7000	--	1,000	1991- on	
Total	435			
INACTIVE				
	None reported			
Inquiries to Purchase				
ACTIVE				
90-1100B	15	--	1991	UF6e
90-1177B	60	--	1991	UF6e
88-1061	--	500	1991-1995	
90-1076	--	350 per year	1992-1998	
90-1094	--	500	1992-2000	
90-1144	--	60 per year	1992-2001	
90-1181*	--	600	1996-2003	UF6e
Total	75			
INACTIVE				
	1,545			

* New or revised since last month.

¹ For delivery within one year, measured from the date of this Report. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

² For delivery beyond one year, measured from the date of this Report.

Active Projects reclassified as Inactive since last month: none

Active Projects removed since last month: 89-1262.

MARKET REVIEW

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

Exchange Value¹

Country (currency)	per lb equivalent U3O8 as Concentrates			per kg U as Concentrates		
	This Month (July 31, 1990)	Last Month (June 30, 1990)	12 Months Ago (July 31, 1989)	This Month (July 31, 1990)	Last Month (June 30, 1990)	12 Months Ago (July 31, 1989)
Australia (dollar)	14.78	14.74	13.09	38.42	38.32	34.04
Belgium (franc)	386.27	398.63	387.81	1.004	1.036	1.008
Canada (dollar)	13.48	13.56	11.60	35.06	35.24	30.17
EEC (ecu)	9.11	9.38	8.86	23.68	24.39	23.03
Finland (markka)	44.06	45.58	41.63	114.54	118.49	108.23
France (franc)	62.83	65.14	62.70	163.34	169.35	163.01
Italy (lira)	13,747	14,233	13,322	35,739	37,003	34,635
Japan (yen)	1,732	1,775	1,368	4,502	4,614	3,555
Netherlands (guilder)	21.18	21.83	20.89	55.05	56.76	54.31
So. Africa (comm. rand)	30.41	30.79	26.16	79.07	80.06	68.01
Spain (peseta)	1,154	1,191	1,159	3,001	3,097	3,014
Sweden (krona)	68.50	70.22	63.10	178.09	182.55	164.06
Switzerland (franc)	15.91	16.48	15.93	41.35	42.84	41.43
UK (pound)	6.33	6.67	5.95	16.46	17.35	15.48
US (dollar)	11.70	11.60	9.80	30.425	30.16	25.48
West Germany (mark)	19.46	19.39	18.52	50.59	50.42	48.13

Transaction Value¹

Country (currency)	per lb equivalent U3O8 as Concentrates			per kg U as Concentrates		
	This Month (July 31, 1990)	Last Month (June 30, 1990)	12 Months Ago (July 31, 1989)	This Month (July 31, 1990)	Last Month (June 30, 1990)	12 Months Ago (July 31, 1989)
Australia (dollar)	12.32	11.18	13.29	32.02	29.07	34.56
Belgium (franc)	321.89	302.41	393.75	836.84	786.19	1,024
Canada (dollar)	11.24	10.28	11.78	29.21	26.74	30.63
EEC (ecu)	7.59	7.12	8.99	19.73	18.51	23.38
Finland (markka)	36.71	34.57	42.27	95.45	89.89	109.89
France (franc)	52.36	49.42	63.66	136.12	128.47	165.50
Italy (lira)	11,456	10,798	13,526	29,782	28,071	35,166
Japan (yen)	1,443	1,346	1,389	3,751	3,500	3,610
Netherlands (guilder)	17.65	16.56	21.21	45.88	43.06	55.14
So. Africa (comm. rand)	25.34	23.36	26.56	65.89	60.73	69.05
Spain (peseta)	961.82	903.77	1,177	2,501	2,350	3,060
Sweden (krona)	57.08	53.27	64.07	148.41	138.49	166.57
Switzerland (franc)	13.25	12.50	16.18	34.46	32.50	42.06
UK (pound)	5.28	5.06	6.04	13.72	13.16	15.72
US (dollar)	9.75	8.80	9.95	25.35	22.88	25.87
West Germany (mark)	16.21	14.71	18.80	42.16	38.25	48.87

¹ Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

MARKET REVIEW

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

Conversion Value ¹						
Country (currency)	per lb U as UF ₆			per kg U as UF ₆		
	This Month (July 31, 1990)	Last Month (June 30, 1990)	12 Months Ago (July 31, 1989)	This Month (July 31, 1990)	Last Month (June 30, 1990)	12 Months Ago (July 31, 1989)
Australia (dollar)	1.83	1.84	2.61	4.04	4.06	5.74
Belgium (franc)	47.87	49.83	77.17	105.54	109.85	170.12
Canada (dollar)	1.67	1.69	2.31	3.68	3.74	5.09
EEC (ecu)	1.13	1.17	1.76	2.49	2.59	3.89
Finland (markka)	5.46	5.70	8.28	12.04	12.56	18.26
France (franc)	7.79	8.14	12.48	17.17	17.95	27.50
Italy (lira)	1,704	1,779	2,651	3,756	3,922	5,844
Japan (yen)	214.59	221.85	272.12	473.09	489.09	599.92
Netherlands (guilder)	2.62	2.73	4.16	5.79	6.02	9.16
So. Africa (comm. rand)	3.77	3.85	5.21	8.31	8.49	11.48
Spain (peseta)	143.04	148.92	230.69	315.35	328.30	508.58
Sweden (krona)	8.49	8.78	12.56	18.72	19.35	27.68
Switzerland (franc)	1.97	2.06	3.17	4.35	4.54	6.99
UK (pound)	0.78	0.83	1.18	1.73	1.84	2.61
US (dollar)	1.45	1.45	1.95	3.20	3.20	4.30
West Germany (mark)	2.41	2.42	3.68	5.32	5.34	8.12

SWU Value and UF ₆ Value ¹						
Country (currency)	SWU Value at 0.30% Tails Assay			UF ₆ Value per kg U as UF ₆		
	This Month (July 31, 1990)	Last Month (June 30, 1990)	12 Months Ago (July 31, 1989)	This Month (July 31, 1990)	Last Month (June 30, 1990)	12 Months Ago (July 31, 1989)
Australia (dollar)	63.16	63.54	88.18	41.05	40.67	40.08
Belgium (franc)	1,651	1,718	2,612	1,073	1,100	1,187
Canada (dollar)	57.62	58.43	78.15	37.46	37.40	35.52
EEC (ecu)	38.92	40.44	59.66	25.30	25.88	27.11
Finland (markka)	188.27	196.45	280.37	122.38	125.73	127.44
France (franc)	268.50	280.77	422.26	174.52	179.69	191.93
Italy (lira)	58,748	61,350	89,723	38,186	39,264	40,783
Japan (yen)	7,400	7,650	9,210	4,810	4,896	4,186
Netherlands (guilder)	90.50	94.11	140.69	58.82	60.23	63.95
So. Africa (comm. rand)	129.97	132.73	176.19	84.48	84.95	80.08
Spain (peseta)	4,932	5,135	7,808	3,206	3,286	3,549
Sweden (krona)	292.74	302.66	424.98	190.28	193.70	193.17
Switzerland (franc)	67.97	71.02	107.32	44.18	45.45	48.78
UK (pound)	27.06	28.76	40.10	17.59	18.41	18.22
US (dollar)	50.00	50.00	66.00	32.50	32.00	30.00
West Germany (mark)	83.15	83.60	124.69	54.05	53.50	56.67

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

RECENT DEVELOPMENTS

USA

National Energy Strategy Update

The development of a National Energy Strategy (NES) has been underway for just over one year. On July 26, 1989, President Bush directed the Secretary of Energy to submit to the President a national energy plan based on the following guidelines.

- ◆ Develop an energy strategy through the year 2050 that can be implemented as soon as possible, rather than waiting until the next energy crisis.
- ◆ Formulate the program so that it will create public consensus.
- ◆ Build upon market reliance, rather than coercion.
- ◆ Take a "can do" approach; capitalize on US scientific knowledge and common sense.

Fifteen public hearings were held throughout the country and included testimony of 375 witnesses from 43 states. In addition, over 1,000 written opinions were submitted as input for the composition of the NES. The Department of Energy summarized the public comments and released an interim report in April 1990. Additional comments were due in early July. An inter-agency task force is reviewing the public comment and is beginning to negotiate policies to be included in the NES. The analysis and identification of options is scheduled to be completed by August. Preliminary results are expected following completion of the final review and analysis in September or October. The Energy Department plans to submit the formal proposal to the President by the end of the year for his approval during first quarter 1991.

Four major themes emerged from the public dialogue.

- ◆ Increase efficiency of energy use.
- ◆ Secure future energy supply sources.
- ◆ Respect the environment.
- ◆ Fortify the nation's foundations.
 - Increase basic science and research.
 - Improve our educational system.
 - Transfer our research into workable technology.

In the case of nuclear power, opinions varied widely and debate was frequently animated, yet most witnesses agreed that nuclear power could make a significant contribution to the growing national requirements for base-load electricity. However, the solutions to four major obstacles must be effectively communicated to the public.

- ◆ **Safety of Nuclear Power**—The industry must demonstrate that it can maintain exacting standards of safety in the design and operation of nuclear power plants and related fuel-cycle facilities.
- ◆ **Disposal of Waste Material**—The industry must show it has the technical capability to package, transport, and dispose of spent fuel and high-level radioactive waste in a safe, timely, and environmentally acceptable manner.
- ◆ **Licensing and Regulation**—The predictability and efficiency of the licensing and regulatory process must be improved and streamlined, while still assuring compliance with safety requirements.
- ◆ **Economics of Nuclear Power**—Industry and government must eliminate barriers to efficient and cost-effective operation of nuclear facilities, and demonstrate to the general public and to investors that nuclear power can be produced economically.

Only when these obstacles are overcome, will nuclear power once again be considered a viable alternative for new electrical capacity in the USA. Nevertheless, nuclear power will remain a key supply source, albeit controversial, in the nation's energy strategy. □

RECENT DEVELOPMENTS

USA

EdF subsidiary to purchase Malapai

A subsidiary of Electricité de France, in a venture with Total Minerals Corporation (TOMIN—a wholly-owned subsidiary of TOTAL Compagnie Française des Pétroles of France), has reached a tentative agreement to purchase Malapai Resources Company from Pinnacle West Capital Corporation. The deal is expected to be completed within 60 days. EdF made the purchase through its wholly-owned subsidiary, Société Auxiliaire d'Énergie (SAE). SAE established a US-based subsidiary known as FITCO (Fuel International Trading Corporation) to, among other goals, purchase 100 percent of Malapai's stock for a reported price of \$38 million.

Although EdF (through FITCO) essentially purchased 100 percent of Malapai, the transaction was structured in a much more complex fashion (**Figure 1**). A joint venture with TOMIN was created to overcome some obstacles and achieve the various goals of all of the parties involved. All of the costs and revenues associated with the TOMIN and Malapai properties will be combined into this new joint venture, which has not yet been named. The new venture will be 29 percent owned by FITCO and 71 percent owned by TOMIN. TOMIN will be the operator of all of the properties (that is, the former individual properties of Malapai and TOMIN), as well as be responsible for the marketing of the venture's production and servicing its contracts. A chief reason for the joint venture structure apparently was to overcome the French government's conviction that it was beyond EdF's mandate as a power producer to own a majority share of a mining company. Another result of the venture is that FITCO will own 29 percent of a much larger uranium-producing enterprise, as opposed to 100 percent of a smaller production entity (Malapai alone).

TOMIN's existing uranium operations and properties include:

- West Cole—an operating in-situ leach (ISL) facility in south Texas;
- Alta Mesa—an in-situ leach project under development in Texas;
- a 45-percent share in Rhode Ranch, the largest conventional uranium strip-mining operation in the USA. Chevron is the operator of this 1.5 million pound per year facility.

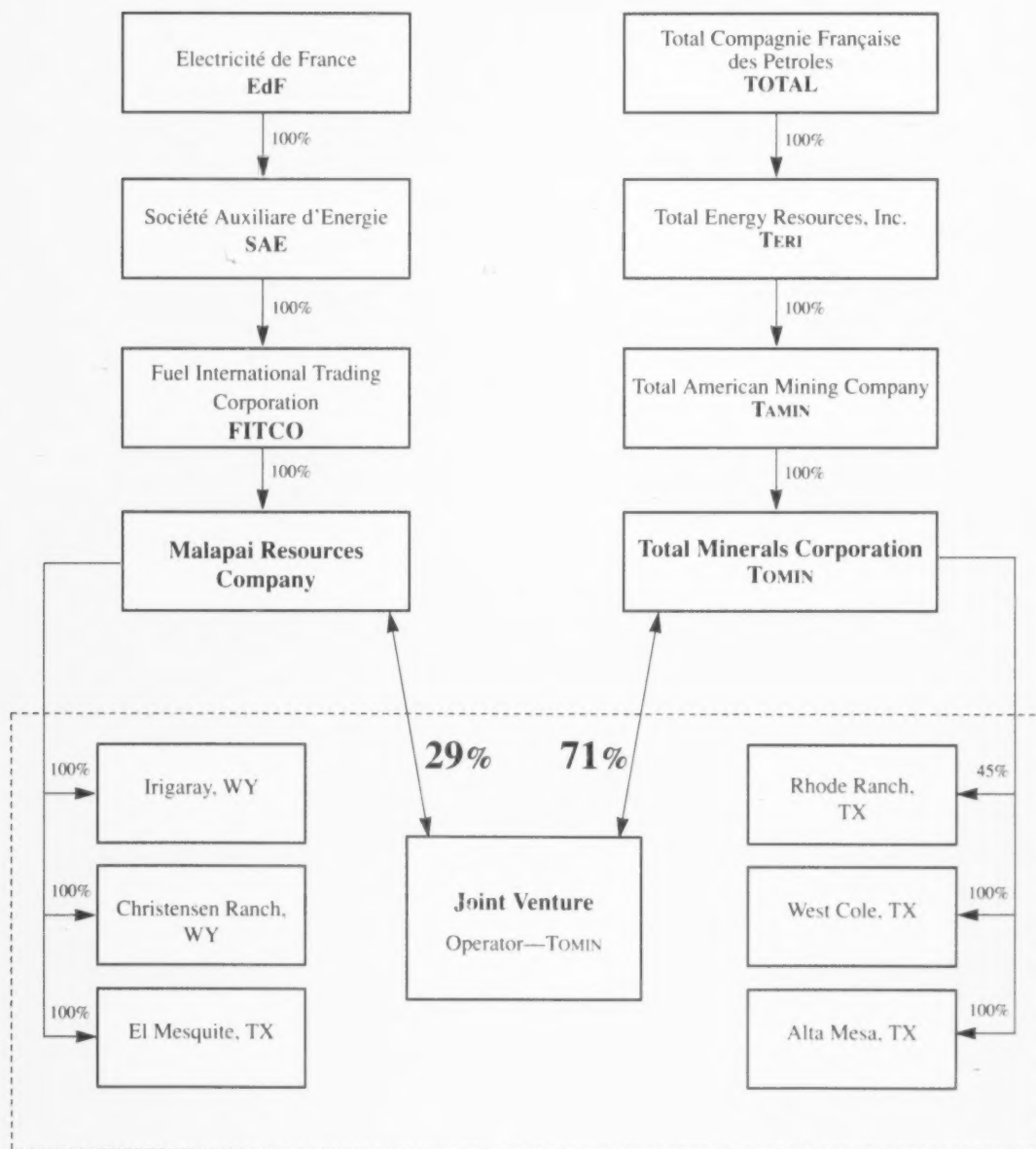
TOMIN's participation in the venture will result in increased production capability and an increase in its reserve base to around 45 million pounds. Malapai will continue to exist as a legal entity, using its own inventory to fulfill its long-term contracts. This attractive contract portfolio includes two contracts in Europe, two in the USA, and three in the Far East. Malapai's uranium properties are in-situ leach operations that include Irigaray and Christensen Ranch in Wyoming, and El Mesquite in Texas.

TOMIN was a logical choice as a partner-for FITCO because of its ISL experience at West Cole, Texas, and the fact that both companies are French-owned. The establishment of the joint venture will secure TOMIN's position as one of the largest US uranium producers.

Some hurdles must still be overcome to complete the transaction, including normal approval by regulators in Wyoming and Texas. Malapai's headquarters in Phoenix, Arizona is expected to close, and administrative responsibilities consolidated in TOMIN's Houston, Texas headquarters. ■

RECENT DEVELOPMENTS

Figure 1
OWNERSHIP AND OPERATING INTERESTS
OF TOTAL AND MALAPAI PROPERTIES



RECENT DEVELOPMENTS

WASHINGTON FOCUS

Recent weeks have seen considerable Congressional activity on uranium enrichment legislation. On August 2, the Senate passed the Energy & Water Development Appropriations Bill, which funds the DOE and NRC programs. A conference committee must be convened to work out the differences between the House and Senate versions of the Bill. The House Science, Space and Technology subcommittee held one hearing, and also a markup of HR 2480, the House bill to restructure the uranium enrichment program as a government corporation. Also in the House of Representatives, subcommittees of the Energy and Commerce Committee, and the Interior and Insular Affairs Committee held a joint hearing on the Smith Barney report on DOE restructuring. Lastly, the USCEA's Nuclear Fuel Supply Committee met in San Francisco near the end of July.

Senate Energy Appropriations Bill

On August 2, the Senate approved its version of the Energy and Water Development Bill (HR 5019), which funds the DOE and NRC programs. The Senate version would appropriate a total of about \$20.7 billion, about \$7 million more than the House version of the Bill. The Senate version allocates \$45.5 million more than the House Bill for nuclear energy research and development, but reduces the appropriations for DOE's uranium enrichment program to \$1.34 billion (based on lower projected revenues of \$1.45 billion). DOE submitted a revised FY91 budget estimate which, if accepted, will result in a \$72.4 million net reduction of appropriations from FY90. The reduction is a result of lower projected revenue due to an expected \$59 million reduction in defense program sales, and the planned reduction of Gaseous Diffusion Plant (GDP) operating expenses by \$135.7 million through the purchase of lower-cost electricity. Some of the savings from the reduced operating expenses will be spent on construction and improvements at the GDP sites, and environmental cleanup.

The Senate Appropriations Committee, when it approved the Bill on July 19, approved full funding for AVLIS (\$154.5 million), and gave DOE additional instructions to proceed with AVLIS technology demonstration and deployment as quickly as possible. The committee agreed with the House in refusing to consider DOE's request to establish a decommissioning and decontamination (D&D) fund, or its request to purchase enrichment services. Instead, the Senate and the House indicated they will consider these issues when formulating legislation to restructure the uranium enrichment program. The conference committee will convene after the summer recess.

House Uranium Enrichment Restructuring Bill

The Energy Research & Development (R&D) subcommittee of the House Science, Space and Technology Committee (one of the three committees with jurisdiction over uranium enrichment) has completed action on HR 2480. On July 11th, the subcommittee held a hearing on Smith Barney's recommendations and proceeded to mark up HR 2480 on July 19th. Amendments modified several important areas.

- The bill no longer requires any repayment of "unrecovered costs."
- The corporation will be financially responsible for all three GDPs, including environmental cleanup and the eventual D&D of the plants. The corporation would contribute five percent of gross revenues to a fund specifically created for this purpose.
- The bill does not mandate the licensing of the GDPs, but describes an NRC licensing process that the enrichment corporation must initiate.

RECENT DEVELOPMENTS**Joint Subcommittee
Hearing on Smith Barney
Report**

Even though the Smith Barney report makes an excellent argument for assigning no initial debt to the enrichment corporation, the National Taxpayers Union (NTU) is still lobbying the House to require the corporation to assume a debt of \$10 billion, which would ultimately be paid by its nuclear utility customers.

Rep. Schiff (R-NM) introduced an amendment which would create a \$300 million mill-tailings cleanup fund, which the federal government would manage. Markup by the full committee has been delayed until after the summer recess, due to Rep. Wolpe's (D-MI) request to have a full-committee hearing prior to the markup.

◇ On July 31, House subcommittees from the Energy and Commerce Committee, and the Interior and Insular Affairs Committee, held a joint hearing on the Smith Barney report. Rep. Phil Sharp (D-IN) and Rep. George Miller (D-CA) co-chaired the hearing. DOE Under Secretary Henson Moore, Frank Zarb of Smith Barney, Victor Rezendes of GAO, Charles Montange of NTU, and Joseph F. Paquette, Jr., CEO of Philadelphia Electric Company appeared as witnesses.

Most of the questions directed at the witnesses expressed an underlying concern about future liabilities and who is to pay for them. Led by Rep. Miller, critics of DOE and the nuclear industry seemed most concerned with protecting the taxpayer from the financial risks, which are perceived as similar to the bail-out of the savings and loan industry. Many of the questions focused on the unrecovered debt issue. Based on Smith Barney's analysis, it matters not what figure is determined as the debt. Rather, (as even the General Accounting office stated) it is most important that any future entity, either government or private, should not be saddled with a level of debt that would render that entity non-competitive. One persuasive argument for uranium enrichment program privatization, is that private capital markets would make the determination about AVLIS construction, rather than the government, so AVLIS risks would not be borne by the taxpayer. Rep. Sharp and Rep. Dingell appeared willing to consider this issue, particularly because of Mr. Zarb's credibility with the committee deriving from his previous work with Conrail. In addition, if structured correctly, the enrichment corporation could return large sums of money to the Treasury. The fate of the bill this year may be determined by the progress made on the Clean Air bill; if it is passed, Congress may have time to consider enrichment legislation.

**DOE Responds to Senate
Questions on Uranium
Enrichment**

◇ DOE released its answers to questions posed by the Senate Energy and Natural Resources committee as a result of a May 1 hearing on uranium enrichment. Among the issues of most concern to the Senators were: DOE's schedule and method for deployment of AVLIS; the impact on DOE of acid rain legislation; decommissioning, decontamination, and environmental cleanup; and the loss of DOE's market share to Technisabexport (TENEX). Chairman Bennett Johnson asked if additional regulations were needed to use AVLIS for the production of highly-enriched uranium (HEU). DOE maintains that, as currently conceived, AVLIS is designed solely for commercial low-enriched uranium (LEU) production and could be used to enrich HEU only if "significant hardware modifications are made." In a series of questions on D&D and environmental cleanup funds for the enrichment plants, Senator Ford questioned DOE's assessment of the amount necessary, and its ability to collect sufficient funds to pay for these programs. DOE maintains that it has the authority to collect and fund (as currently incurred) the money necessary for environmental cleanup. In FY91, DOE will begin to collect, through its prices, the \$3 billion it estimates will be

RECENT DEVELOPMENTS

**USCEA Nuclear Fuel
Supply Committee Meeting**

necessary to decommission and decontaminate the GDPs. However, for DOE to accomplish the D&D when it is necessary (after 2005), it must retain the money beyond one fiscal year, which is not yet within DOE's authority.

Senator McClure asked what has been done to reduce DOE's power costs. DOE indicated that it anticipates saving more than \$100 million per year by purchasing non-firm power (up to 30% of requirements), mainly from Paducah. Rep. Ford asked what quantity of enrichment services DOE anticipates purchasing from TENEX. In response, DOE stated that it is currently contemplating the purchase of just one to two million SWU, and only if the SWU could be purchased below DOE's marginal cost of production. DOE also said that if it does purchase SWU, any resulting savings would be passed along to its customers in the form of lower prices.

AVLIS and CRISLA were the main topics at the USCEA's Nuclear Fuel Supply Committee meeting on July 25th. Dr. Michael J. Stephenson, who is responsible for Martin Marietta's interface with industry on the AVLIS program, described their work on the feed and product programs. He informed the audience that UO_3 had tentatively been selected as the form for both feed and product. Although no final selection has been made, this decision is based on what DOE feels are important health, safety, environmental, and economic considerations. When AVLIS was selected over GCEP, it was based on the assumption that AVLIS would use UF_6 . But eliminating the fluorination process improves the economics of AVLIS by about 25 percent. DOE contractors calculated a savings of \$6-9 per SWU by eliminating the fluorination step in the feed component, and a \$2-4 per SWU reduction in costs if metal is converted back to powder for the product. However, it is unclear if DOE considered the additional costs to convertors and fabricators to build and operate dual lines to handle both UO_3 and UF_6 while AVLIS is being incrementally deployed. Even if the selection of UO_3 proves correct, the lack of dialogue with the industry prior to its selection, especially with the convertors, will cause resistance to its acceptance. If UO_3 is selected, this also could cause utilities and fabricators to maintain additional inventory while the shift from UF_6 to UO_3 takes place. The consideration of these additional costs throughout the fuel cycle may demonstrate that UO_3 is not the best choice.

The selection of the chemical forms for the AVLIS feed and product is a crucial step in the commercialization of AVLIS, as it represents the interface between the US government and private industry. For example, the selection of UO_3 as the AVLIS feed, rather than the uranium metal actually used in the AVLIS process, appears to increase the scope of the AVLIS program beyond the minimum required for enrichment. This appears to conflict with DOE's often-stated intentions not to compete with the private sector. Several private industry sources have the capability of producing uranium metal from UF_4 and UF_6 , and DOE admitted that excess capacity exists. Although UO_3 is only a slight refinement from the yellowcake produced at the mill, it is the purity of the UO_3 that is important to AVLIS. Although DOE is considering a specification for UO_3 , it would not discuss a uranium metal specification. The UO_3 specification calls for a much higher purity than the uranium oxides typically produced at uranium mills, so AVLIS will still need an additional purification step similar to that used in the current conversion process.

Dr. Stephenson also announced the tentative selection of metallothermic reduction of UCl_4 with magnesium metal, as the DOE process for producing uranium metal from UO_3 . The waste stream from the proposed process is magnesium chloride,

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which is recyclable, thus producing fewer environmental concerns than the reduction of UF₄ or UF₆. Since DOE considers it unlikely that private industry will invest in the development of the UCl₄ process prior to the construction of an AVLIS facility, DOE plans to fund development itself.

Dr. Stephenson explained that the enriched uranium metal collected from the AVLIS enrichment process needs to be purified and further processed to adjust enrichment, so it will be dissolved in nitric acid to form ammonium diuranate. After processing, normal industry methods will be used to convert the material to UO₃. DOE explored the alternative of producing UO₂ powder which could be used directly for pellet fabrication, but concluded that there was not a standard UO₂ specification which would be acceptable to all of the fabricators. In this instance, DOE also may have been motivated by the desire to avoid reducing the fabricators' business scope.

DOE announced that contracts have been signed with all five US-based fabricators for initial study of the alterations necessary to the fabrication processes. Although the funding under the contracts is minimal, these contracts begin the process of encouraging the fabricators to accept the AVLIS product. DOE has applied considerable effort to define the AVLIS interface, but most of the effort to date has been internal to DOE, Lawrence Livermore Laboratories, and Martin Marietta. DOE may be concerned that converters and fabricators will place very conservative cost estimates on the process modifications necessary to utilize AVLIS enrichment unless DOE has successfully demonstrated the modifications. It is unlikely that private industry will make any significant investment to develop the AVLIS infrastructure until the decision is made to build an AVLIS facility. Thus, DOE must make the investment to confirm the costs for the private sector, to prevent utility customers from rejecting the AVLIS process as uneconomic or too risky. DOE may also be looking to take a larger share of the front end of the fuel cycle after privatization of the enrichment enterprise. In either case, it was apparent that the introduction of AVLIS will cause some major changes in the fuel cycle, and the definition of the AVLIS interface will require much more coordination among all of the fuel cycle participants.

**Isotope Technologies
CRISLA Progress Report**

John Hardin of Isotope Technologies (ITI) presented a progress report on CRISLA. He revealed that the testing phase at ITI's Los Angeles laboratory is complete. After testing a range of chemical re-agents, ITI has selected a mixture of silane and hydrogen bromide for the work to follow. ITI believes it can develop a small (200-250 thousand SWU per year) plant that will be competitive in the long-term market. Over the past year, ITI has increased its marketing activities and hopes to have several long-term contracts signed soon. Mr. Hardin announced that a new development site should be identified very soon, and that negotiations with two industrial partners are nearly complete. The two partners are an architectural/engineering firm and a large nuclear fuel cycle company, with "lots of uranium handling experience." One of the partners has a demonstration site which is already licensed and will require only minor modifications. One important advantage of the new partnership will be access to a larger research base. ITI plans to construct a CRISLA unit which is five to ten times larger than their current research equipment, and hopes to operate the demonstration unit by 1992. ■

RECENT DEVELOPMENTS

INDUSTRY BRIEFS

Japan Completes Test Plant For Laser Enrichment

The Laser Atomic Separation Engineering Research Association, referred to as LASER-J, announced on May 14th the completion of an experimental laser-enrichment plant at the Tokai Research Establishment. The plant is designed to produce 1,000 SWU per year using the AVLIS method. Laser-J initiated plant construction in June 1989. It will perform experiments aimed at confirming the technical feasibility of the process over the next two years. LASER-J, created in April 1987, is a joint investment by nine utilities, the Central Research Institute of Electric Power Industry, Japan Nuclear Fuel Industries and the Japan Atomic Power Company.



Saskatchewan Reveals Buyer Percentages

The Ministry of Energy and Mines announced the makeup of the buyers of uranium from Saskatchewan producers in 1989. The US buyers purchased 48% of production; the balance went to Europe (31%), Japan and Korea (12%), and eastern Canada (9%).

West German Utilities To Take Over East German Utilities

East German authorities from the ministry responsible for energy and environmental matters, and from the state trust that holds shares in the country's enterprises, have reached an agreement in which West Germany's three largest utilities, Bayernwerk AG, Preussenelektra AG and RWE AG, will assume control of East Germany's electrical generation industry. East and West German antitrust authorities have yet to comment on whether they will approve the agreement. Only limited details of the plan have been made available.

The plan is separated into two phases. In the first phase, the West German utilities jointly assume a caretaker role, and immediately invest DM2.6 billion to fund the modernization of East Germany's network of utilities. In the second phase, the West German utilities receive an equity interest. The parties to the agreement have not released the timing or the percentage share of these equity acquisitions. It is likely that the three West German utilities then will each control a specific utility region in East Germany.

Mexico Studying Construction Of 20 New Nuclear Plants

As a result of dwindling oil supplies, Mexico is performing technical studies for 20 additional nuclear power plants. Mexico has little coal, gas, thermal, or additional hydro resources to utilize. It also lacks enough foreign exchange to obtain fuels or electricity from other countries. These studies for this ambitious plan are preceding, even though Mexico's yet-to-be licensed Laguna Verde-1 took 15 years and over \$3 billion to complete, and despite Laguna Verde-2 being Mexico's only other reactor presently approved or under construction.



Cogema Signs Reprocessing Contracts For 15 West German Reactors

At a July 9th press conference, Cogema Chairman Jean Syrota announced the signing of contracts with 11 West German utilities for the reprocessing of nuclear fuel from 2001 through 2015. The quantities reprocessed should approximate one-half of the total West German market. The companies, including Bayernwerk, Preussenelektra, and RWE, already had contracts with Cogema for reprocessing their discharged fuel through 2000.

RECENT DEVELOPMENTS

**DOE's FY91 Incentive Price
(IP2) Predicted**

NUEXCO estimates an FY91 IP2 cost of \$100.60 per SWU. The estimate is based upon the US government's just-released preliminary value of 130.9 for the second quarter of 1990 Gross National Product Implicit Price Deflator (GNPID) and the most recent second quarter 1985 GNPIPD. To calculate the IP2 value for FY91, multiply the base incentive price of \$85 by the ratio of the GNPIPD for the second quarter of 1990 (130.9) to the GNPIPD for the second quarter of 1985 (110.6). [$\$85 \times (130.9/110.6)$].

**West Germany
Decommissions Sole
Uranium Processing Plant**

Gewerkschaft Brunhilde GmbH will be decommissioning its Ellweiler uranium ore processing plant. Alfred Beth, minister of environment and chief nuclear licensing official in the state of Rhineland-Palatinate, suspended the operator's license for the plant on May 31, 1989, because radon gas emanating from mill tailings in the waste dump was found to exceed the 30mrem maximum set by a German radiological protection ordinance. Decommissioning of the plant, near Trier in west-central West Germany, is set to proceed once work on the waste dump is completed in August.

**Argentina's Atucha-2
May Be Closed or Sold**

Argentine officials stated they may have to quit construction of the country's third nuclear reactor, Atucha-2, due to costs overruns that Argentina can no longer afford. Government officials estimate that the 692-MWe (net) unit will cost US\$1.4 billion to complete, a figure nearly 90 percent of the original estimate to construct the entire plant. As an option, Argentina may sell the entire project to a private enterprise, or preferably, seek out private companies to finance the project's completion, while CNEA (Comision Nacional de Energia Atomica) would remain the operator. The plant was most recently estimated to come on line in 1994, already a seven-year delay from the original plans.

**West Germany
To Buy Nukem Plant
For Plutonium Storage.**

The West German Federal Government intends to buy Nukem's fuel fabrication plant. Until it was recently shut down, the plant had been used to provide special fuel elements to the THTR-300 reactor. West Germany plans to store up to 2.5 tons of plutonium in the former fabrication facility.

**Saskatchewan Revises
Uranium Royalty System**

The Ministry of Energy and Mines in Saskatchewan, Canada recently put into effect a new system of royalties for uranium sellers. The new system is retroactive to July 1, 1989, and replaces the previous system which was initiated in 1976 and revised in 1980. Of particular note: a company can now allocate expenditures among joint venture partners based on each partner's invested share of the expenditure, rather than the previous method wherein the determination of the share of the expenditure was based solely on the each partner's percentage share of ownership in the mineral lease; a 15 percent royalty is assessed on gross sales, and is added to a royalty on profits (which are no longer derived from return on capital invested) which ranges from 15 to 50 percent, increasing in cumulative steps as profits increase.

WORLD ENRICHMENT SERVICES MARKET 1990—2005

The following article summarizes the Enrichment Services section of the 1990 NUEXCO Market Analysis and Price Trend Projections for Nuclear Fuel Materials and Services. That section reviews the forecast of enrichment requirements and projected capacities for 1990–2005, and enrichment technologies and suppliers. The complete report, available from NUEXCO Information Services, contains a detailed forecast of the entire market.

Overview

Growth in world enrichment capacity, already in oversupply, will lead to a very competitive enrichment services market by the second half of the 1990s. Three of the four primary enrichment suppliers (USDOE, Eurodif, and Urenco) already have the capacity to produce 33 million SWU per year (Table 1). Exports from the

Soviet Union and the People's Republic of China (PRC) currently make available an additional six million SWU per year, and that figure could rise substantially. With additional supply capability expected from China, the Soviet Union, Louisiana Energy Services (LES) and Isotope Technologies (ITI), and the increased capacity of Urenco, and possibly even AVLIS from DOE, enrichment supply capability could exceed 46 million SWU per year by the year 2000 (Figure 1). Yet annual enrichment requirements are only estimated to grow from 23.5 million SWU in 1990, to 28.9 million SWU by 2000. Total unfilled enrichment requirements will rise significantly in the second half of the 1990s, particularly from US utilities, creating sales opportunities for which suppliers will compete aggressively.

These factors foretell a very competitive market in which sellers will offer low prices and flexible contracts. The

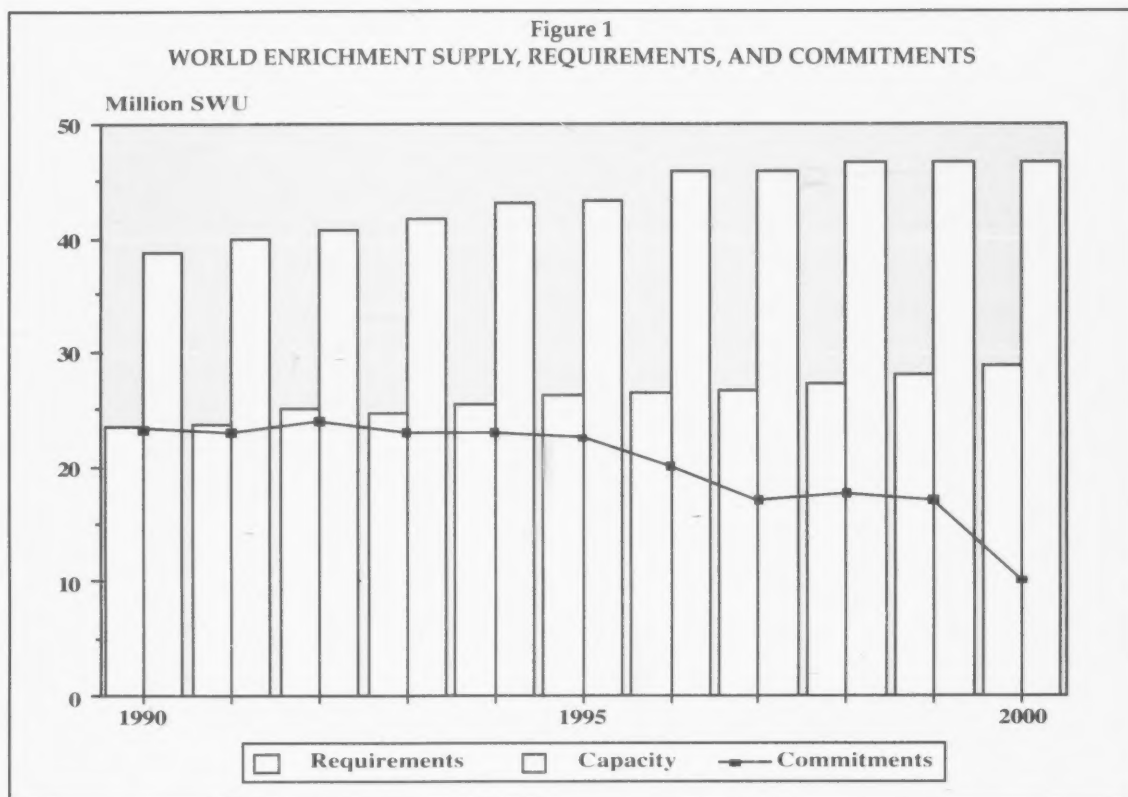
anticipation of such strong competition also raises the question of which enrichment technology will succeed, and puts tremendous pressure on all suppliers to find cost-effective means of production as quickly as possible.

Enrichment Requirements

NUEXCO's projection of enrichment requirements is based upon a forecast of electric generating capacity and subsequent forecasts of requirements throughout the fuel cycle. This article uses data from the reference growth case, and assumptions used in these projections are consistent with our other 1990 fuel cycle requirements forecasts. NUEXCO's July 1990 Monthly

Table 1
WORLD ENRICHMENT SUPPLIERS—1990

Supplier	Plant	Enrichment Process	Initial Production Date	Nameplate Capacity (Million SWU/year)
DOE	Paducah, KY Portsmouth, OH	Gaseous	1954	11.3
		Diffusion	1956	<u>7.9</u> 19.2
Eurodif	Georges Besse, France	Gaseous Diffusion	1979	10.8
Urenco	Capenhurst, UK Almelo, Netherlands Gronau, W. Germany	Centrifuge	1976	1.0
			1976	1.5
			1985	<u>0.6</u> 3.1
TENEX	Export from USSR	Centrifuge	1957	3.5
PRC	Export from China	Gas Diffusion		2.5
Japan	Rokkasho	Centrifuge	1988	0.2
TOTAL				39.3



Report (No. 263, p. 22) contains an overview of our projection of generating capacity and uranium requirements.

NUEXCO projects enrichment requirements at 23.5 million SWU in 1990, increasing to 28.9 million SWU in 2000 and 30.7 million SWU in 2005. This is an average annual growth rate of 2.1 percent per year from 1990 to 2000 (Table 2). Regionally, Europe has the largest absolute requirements with 10.1 million SWU needed in 1990, followed by the USA with 9.2 million SWU. The Far East and other countries have the lowest total requirements, but have the highest growth rates through the year 2000. In the category "Other Countries", the preponderance of heavy-water-moderated reactors that use natural uranium fuel causes that category to consume relatively small amounts of enrichment services per unit of installed capacity.

Table 2 PROJECTED ENRICHMENT REQUIREMENTS BY REGION				
Region	Requirements (Million SWU)			Annual Growth 1990-2000 (Percent per Year)
	1990	2000	2005	
Europe	10.1	12.1	13.2	1.8
Far East	4.1	6.2	7.1	4.3
Other Countries ¹	0.2	0.8	0.7	16.2
United States	9.2	9.8	9.8	0.7
Total	23.5	28.9	30.7	2.1

¹ Brazil, India, Mexico, Pakistan, and South Africa

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This projection uses an enrichment tails assay of 0.30 percent U^{235} . **Table 3** shows the cumulative enrichment requirements through 2000 and displays the result of lower tails assays on enrichment requirements. Enrichment requirements would increase by about 25 percent if the tails assay were reduced from 0.3 to 0.2 percent.

Enrichment Capacity

The projected supply of enrichment capacity almost doubles utility requirements through the year 2000. DOE and Eurodif, the two largest western primary enrichment services suppliers, are operating below their nameplate capacity and Techsnabexport (TENEX) of the Soviet Union is exporting only a portion of its capability.

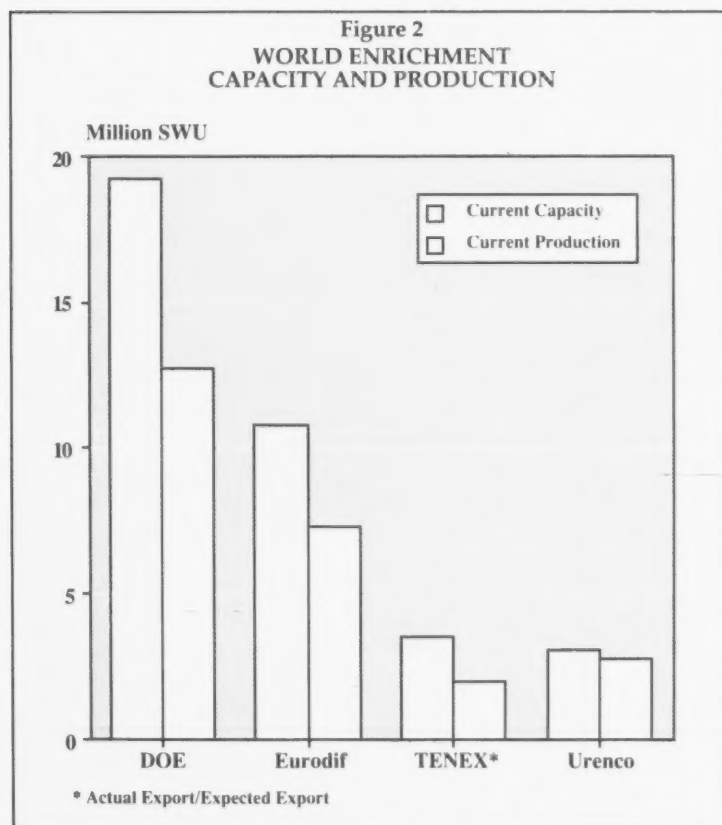
Table 3 CUMULATIVE ENRICHMENT REQUIREMENTS 1990-2000 BY TAILS ASSAY		
Enrichment Tails Assay (percent U^{235})	Million SWU	Relative to Reference Case
0.30	285.7	0.0 %
0.25	316.6	+10.8 %
0.20	356.2	+24.7 %

Figure 2 shows the current capacity and production levels of the four major suppliers of enrichment services. In 1989, DOE produced 12.7 million SWU, which represents only 68 percent of its nameplate capacity. Its capacity of 19.2 million SWU per year accounts for 50 percent of

market capacity. Eurodif produced 8.5 million SWU in 1989, and expects to produce 7.3 million SWU per year during the mid-1990s. This also is only a portion of its 10.8 million SWU capacity, which can be readily expanded to 12.8 million SWU per year by increasing its pumping power.

Urenco produces near its current capacity of 3.1 million SWU per year to meet its long-term commitments. Although its capacity may appear to be largely committed at any particular time, additional centrifuge production capability can be installed in significant increments on relatively short notice. Urenco's strategy permits the installation of additional capacity only at the rate needed to service its contracts.

TENEX's export capability, currently estimated at 3.5 million SWU per year, is expected to rise to five million SWU per year by the mid-1990s, which would represent about 15 percent of the market (**Figure 3**). Additional uncommitted supply totalling nearly two million SWU per year could be available from LES (1.5 million SWU), and Isotope Technologies (250 thousand SWU) by



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the middle of the decade. Exports from China could increase SWU supply by another two million SWU per year. Furthermore, substantial inventories of enriched uranium product (EUP) are currently available through loans or sales. A number of governments and utilities are making this material, estimated at over three million SWU, available to the spot market.

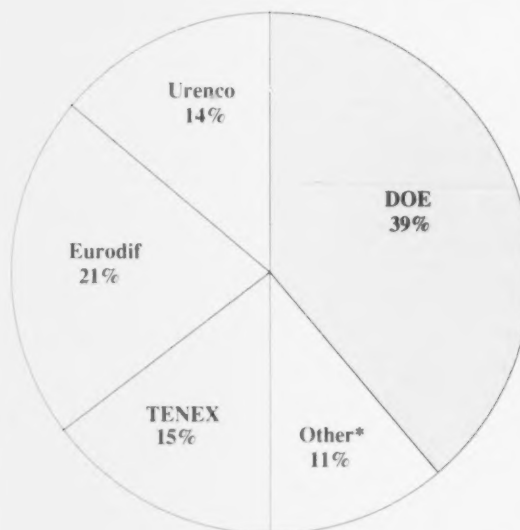
Enrichment Technologies and Suppliers

The large oversupply of enrichment capacity leads to aggressive marketing efforts by suppliers to get contracts, puts pressure on suppliers to have efficient, cost-effective production, and raises a number of questions. Which technology will survive this intense competition? Will centrifuge enrichment from established suppliers such as Urenco and the Soviet Union, or new production from LES take over as the primary technology? Or will the timely demonstration and deployment of laser technology, such as AVLIS and SILVA, save DOE's market share, help Eurodif expand its share, and also offer opportunities to newcomers like Isotope Technologies?

Of all the suppliers, DOE has the most to lose. Major uncertainties facing DOE include the successful deployment of AVLIS technology, acid rain legislation, decommissioning costs for its aging gaseous diffusion plants, environmental compliance, and restructuring legislation. DOE is depending on AVLIS technology to maintain its market leadership. While laser technology does have a significant cost advantage over other technologies (Figure 4), it is as yet unproven on a commercial scale.

Centrifuge processes continue to evolve, becoming more efficient and cost-effective with each new generation of designs. Urenco has lowered its operating and maintenance costs significantly, and reduced its electricity requirements per SWU to only two percent of the electricity requirements of a comparable gaseous diffusion plant. (Specific cost figure estimates for suppliers are provided in the complete report.) The Louisiana Enrichment Services plant (47 percent owned by Urenco) is planned for commercial operation by 1996 with a production capacity of 1.5 million SWU per year, using this new generation of centrifuge cascades.

Figure 3
PROJECTED MID-1990S MARKET SHARE



* PRC, ITI, & LES

SWU Spot Market

The SWU spot market is characterized by demand from a limited number of utilities who purchase some portion of their requirements outside of their primary enrichment contracts, and from intermediaries. Historically, supply in the spot market comes from excess utility inventories and from national stockpiles when the government agency has come under political or financial pressure to sell the material. Primary enrichment suppliers participation in the spot market is infrequent.

NUEXCO projects that the SWU spot price will escalate gradually during the 1990s. This assumes that the introduction of national stockpiles into the spot market may cause prices to drop, but as inventories are exhausted, prices will gradually rise to a level determined by the lowest cost primary enrichment producer. However, other events could affect the market. For instance, if economic events force TENEX to alter its marketing strategy and sell SWU at levels closer to their marginal cost in order to generate more hard currency, this could slow any general price rise. On the other hand, political events could make

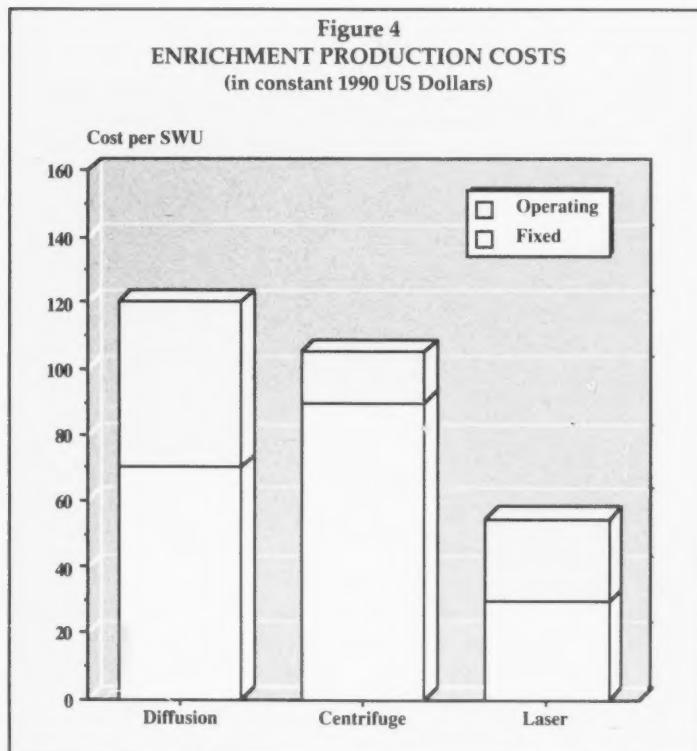
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Soviet material unavailable to western utilities, and thus could cause prices to rise to the level of the next lowest cost producer.

Overall, strong competition for limited demand will preclude any major SWU spot price increase before 1993. As inventories are drawn down and more capacity comes

on line, competition is expected to be fierce for the large unfilled requirements, particularly from US utilities after 1996. The SWU spot market may evolve in a manner similar to the evolution of the conversion market; that is, primary suppliers may sell some SWU into the secondary market at a discount off the long-term price. ■

Figure 4
ENRICHMENT PRODUCTION COSTS
(in constant 1990 US Dollars)



SOUTH AFRICA UPDATE

This article updates some of the key developments in South Africa in the first half of 1990, including uranium production figures, progress on a mining privatization bill, and the status of sanctions levied upon South Africa by the rest of the world.

First Half 1990 Production

Uranium production levels continued to fall in South Africa during the first half of 1990 (**Figure 1**). Second quarter concentrates output dropped to 1.6 million pounds equivalent U_3O_8 , down 9.7 percent compared to the first quarter figure (**Table 1**). First quarter production volume had fallen 7.5 percent from fourth quarter 1989 levels, and second quarter output represents a 16.5 percent decline from the end of 1989. This decrease is largely the result of the March 1990 shutdown of uranium production at Freegold's Joint Metallurgical Scheme operation, South Africa's second largest uranium producer. As of the end of 1989, South Africa's uranium recovery operations were

producing at an annual rate of about 7.5 million pounds. As of mid-1990, that rate has fallen almost 20 percent, to approximately six million pounds per year.

If no further cutbacks occur, and if existing facilities produce at the same level they did during the first half of the year, second-half results would bring South Africa's 1990 output to 6.5 million pounds equivalent U_3O_8 , about 88 percent of 1989's total. But, cutbacks in uranium production are possible for at least three mining facilities: Ergo, Western Areas, and Hartebeestfontein. Those three contributed 24 percent of second quarter 1990 production. If they ceased uranium recovery, Buffelsfontein and Vaal Reefs would be the only remaining South African producers, and annual output would be about five million pounds U_3O_8 , which is about two-thirds of the rate as of the end of the of 1989, and less than one-third of South Africa's peak output.

The uranium section of the Ergo plant could be closed in the mid-1990s because the declining sulfide content of the tailings could render the current system of gold and

uranium recovery uneconomic. Closing the uranium plant and its associated facilities would reduce gold production, but this reduction would be more than balanced by a substantial decrease in working requirements. If Ergo closes, South Africa's annual output, will be cut by approximately 5 percent (382,000 pounds U_3O_8), based on 1989 production levels.

At Western Areas, operating costs currently exceed operating revenues and the company has applied for government assistance in order to continue operations. Such assistance has been granted to other gold mines in the past, but qualifications for assistance are becoming increasingly restrictive. If the government does not grant any

Table 1
SOUTH AFRICA URANIUM PRODUCTION¹ FIRST HALF 1990
(Thousands Pounds U_3O_8)

Operation	Fourth Quarter 1989	First Quarter 1990	Second Quarter 1990	Percent Change ²
Buffelsfontein	187	190	174	-8.1
ERGO ³	87	57	57	-1.2
Freegold ⁴	236	213	85	-60.0
Hartebeestfontein	195	194	179	-7.7
Vaal Reefs	1,021	948	925	-2.4
Western Areas	136	120	135	+11.9
TOTAL⁵	1,863	1,723	1,555	-9.7

¹ Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.

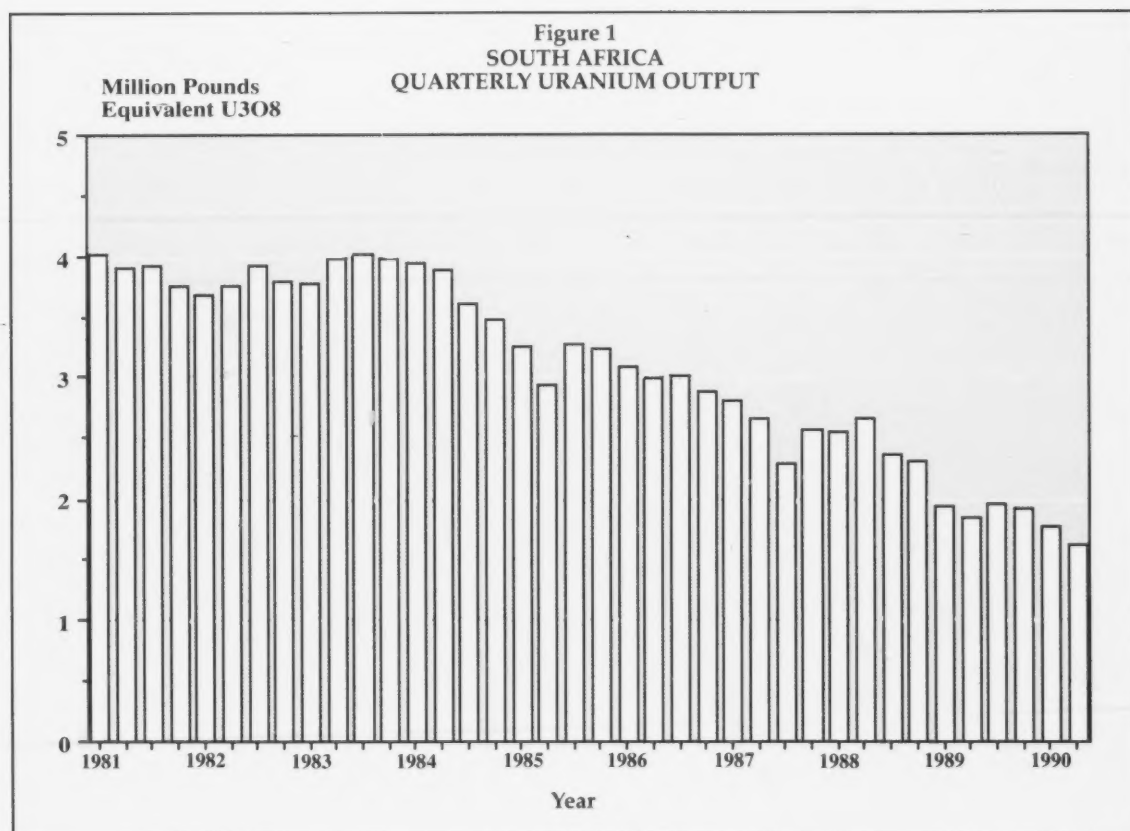
² Change in percent from the first quarter of 1990 using exact production figures.

³ ERGO = East Rand Gold and Uranium Company Ltd.

⁴ Formerly Free State Joint Metallurgical Scheme.

⁵ Addition of columns may not equal TOTAL due to independent rounding.

ANALYSIS AND COMMENTARY



assistance, the operators could be forced to shut down the facility. That would eliminate nearly seven percent of the nation's uranium production.

Hartebeestfontein is currently reporting major financial losses in the production and sale of uranium. However, the financial loss attributed to uranium is more than offset by increased gold recovery because of its use of the reverse leaching system which recovers uranium prior to gold. But that effect is not apparent on the company's income statement, so the perceived loss on uranium has become a cause for concern. To the extent that investors fail to appreciate uranium's contribution to the company's overall profitability, Hartebeestfontein management could come under pressure to terminate or suspend uranium recovery operations.

The shutdown of Freegold's Joint Metallurgical Scheme operation was attributed to decreasing uranium grades and

increasing operating costs. Freegold has indicated however, that tests are underway to determine the feasibility of lower levels of production using selected higher grade feedstock.

Mining Privatization

The South African government, through its Department of Mineral and Energy Affairs, has been considering the reduction its role in the awarding of prospecting and mining rights. The Minerals Bill, the vehicle for this restructuring of the mining industry, was published in preliminary form in 1988 for comment and was discussed with interested parties during 1989. In early 1990, the bill was introduced in Parliament with the expectation that it would be passed during the first half of the year. The fate of the bill, once thought virtually certain to be enacted, is now quite uncertain.

ANALYSIS AND COMMENTARY

The objects of the Bill are consolidation, rationalization, privatization, deregulation, and implementation of principles relating to mining practices and surface rehabilitation. Under present law, the right to mine for certain minerals is vested in the State, which controls such activities by means of a system of mining leases and other forms of mining title. Under the Minerals Bill, the current system would be replaced by one that gives full recognition to the rights of the mineral right holder to prospect, mine, and dispose of minerals, subject to authorization from the State. Such an authorization would be intended as a control mechanism embodying the principles of optimal and safe mining, and surface rehabilitation.

The bill has stimulated much discussion. Although this bill, if enacted, would abolish the current forms of mining lease and other mining title, it also would aim to preserve existing rights. The issues of preservation of existing rights and the desirability of privatization have been some of the most contentious issues in discussions on the bill. Some of its critics object to provisions that would increase the difficulty and expense of controlling mineral properties for long periods of time. Others object to various procedural matters, such as the length of the phase-in period and other implementation provisions. But others make far more fundamental objections to privatization itself. For example, some critics argue that privatization, whether in the mining industry or any other, is designed to transfer the most valuable State-owned assets beyond the reach of the country's black majority. Proponents argue that privatization would enhance competition, thereby fostering growth in the mining industry and contributing to a healthier South African economy from which all citizens would benefit. The Parliamentary Joint Committee appointed to consider the bill and evaluate comments by interested parties is now reassessing the privatization philosophy underlying the bill, so it will not be passed before next year.

This step toward deregulation of the industry, if implemented, would constitute one of the most substantial changes yet undertaken in a series of South African government moves towards privatization of the nation's economy. Its near-term impact would depend primarily on the specific procedures established for its implementation. Its ultimate impact would depend on the outcome of the socio-political struggle in which the country is engaged.

Sanctions Update

South African President F.W. de Klerk has managed to maintain control in his strife-torn country and make some progress toward ending apartheid—enough progress that some individuals and nations are calling for an easing, or even lifting, of sanctions against South Africa. For example, Portugal and Italy have called for a worldwide lifting of sanctions. Britain has lifted its ban on new investment in South Africa, and at a June 26th meeting, the European Community issued a statement promising to relax sanctions if De Klerk's reforms continue.

At the same time, Nelson Mandela is urging the USA—the only nation to impose legislative sanctions—and other nations to continue sanctions in order to extract further concessions from Pretoria. Although studies have shown that sanctions have failed to deny South Africa access to markets and vital commodities such as oil, economic sanctions, as a whole, have imposed tremendous economic penalties on South Africa. For example, a study by the US-based Investor Responsibility Research Center found that sanctions have cost South Africa's economy \$15 billion to \$27 billion.

Although George Bush as Vice President opposed sanctions in 1986 when the US Congress overrode President Reagan's veto of the Comprehensive Anti-Apartheid Act of 1986 (CAAA), Bush administration officials have pledged not to lift sanctions against South Africa until all conditions of CAAA have been met, and only after consulting with Congress. However, not all the requirements of the CAAA have been met. For example, only a handful of the more than 1,000 political prisoners presently held have been released, and De Klerk has not lifted the government's State of Emergency order in the Natal province. Furthermore, no lifting of US sanctions against South Africa is feasible until after the November Congressional elections, for even if all conditions were met beforehand, the Bush administration would be unwilling to face the inevitable political backlash until after the elections. Nevertheless, the South African government is making progress toward a democratic, non-racial society. The time line shown in the accompanying box lists noteworthy events in recent South African history. The lifting of US sanctions, once almost unthinkable, is now only a matter of time. ■

SOUTH AFRICAN TIME LINE

August 15, 1989 — F.W. De Klerk becomes acting president, following the resignation of P.W. Botha.

September 6 — National Party retains power by slender margin in parliamentary elections. De Klerk asserts that results give him a "clear and resounding mandate" to push ahead with plans for evolutionary change.

October 15 — Walter Sisulu and five other African National Congress (ANC) activists released from prison.

February 3, 1990 — De Klerk announces legalization of the ANC, the South African Communist Party, and the Pan-Africanist Congress, and lifts restrictions on 33 other opposition groups.

February 11 — Nelson Mandela released after more than 27 years in prison.

May 2-4 — "Talks about Talks." De Klerk and Mandela lead government/ANC talks on obstacles to negotiations.

June 7 — De Klerk lifts state of emergency, renewed annually by the government since 1986, in all areas except Natal province, still plagued by politico-tribal violence between supporters of Mandela's ANC (primarily Xhosa tribe) and Chief Buthelezi's Inkatha movement (primarily Zulu).

June 19 — Parliament repeals Separate Amenities Act, paving way for integration of all public facilities

June 20 — Mandela begins 12-day, eight city US visit, including address to UN General Assembly.

June 25 — Mandela meets with President Bush, calls on USA to maintain sanctions against the Pretoria government.

August 6 — Mandela and De Klerk make breakthrough agreement clearing the way for full-scale negotiations on a new power-sharing constitution. The ANC announced that it will immediately suspend its 29-year armed struggle against white-minority rule. Beginning September 1, the Pretoria government will allow the phased release of the remaining political prisoners—estimates range from 1,300 to several thousand—and will grant amnesty to about 22,000 anti-government exiles. Crucial to that process are the definition of political offenses and the repeal of internal security laws that have been used to impose criminal penalties for political acts.

US URANIUM EXPLORATION AND DEVELOPMENT UPDATE

The US uranium industry can be compared to someone who has been through a serious accident or trauma; the patient is in a coma, but the vital signs are still there. Though the industry is weak, some exploration and development drilling is still underway, and the industry can return to health if no further complications occur.

Current Activity

In the western United States during early 1990, three to four drill rigs have been engaged in uranium exploration, and about twice that number in development. In the fair weather of summer and fall, traditionally the prime drilling season, the rig count will likely peak between 25 and 30. Thus, at least a portion of the industry seems to be surviving, in spite of the events of the last decade.

In 1990, US uranium exploration activity will be only slightly less than that of the last few years. The two main concentrations of current drilling activity—high-grade breccia pipes of the Arizona Strip mining district, and in-situ leaching (ISL) projects in several western states—had only very minor roles ten years ago. Exploration drilling in the Arizona Strip is a conventional effort focused on the discovery and definition of small cross-section, vertical, breccia pipes that contain high-grade mineralization with average grades approaching 1.0 percent equivalent U_3O_8 . The bulk of the ISL activity is development drilling at projects in Nebraska, Texas, and Wyoming. In addition to those developments, some drilling is taking place in the Uravan district of western Colorado in order to maintain reserves at active mining operations.

Highly speculative exploration is an ongoing process in the Arizona Strip. (For district description see NUEXCO Monthly Reports No. 163, p. 14, and No. 176, p. 19.) Three companies, Energy Fuels, Pathfinder Mines, and Union Pacific Resources, control most of the land in the district and have been active in their exploration efforts for a number of years. Only Energy Fuels has produced any uranium so far, but the other two companies have identified potentially commercial deposits. The exploration efforts of all three companies are supported primarily by foreign interests: Energy Fuels—by a

consortium of Swiss utilities and German interests; Pathfinder Mines—by Cogema of France; and UP Resources—by Taiwan Power Corporation.

During early 1990, UP Resources was the most active explorer, with two rigs in the field for most of the period. While UP Resources has holdings both north and south of the Grand Canyon, the bulk of the drilling took place on the south side, just east of the Hualapai Indian Reservation. The recently published US Geological Survey (USGS) Bulletin 1683-B, *The Potential of Breccia Pipes in the National Tank Area, Hualapai Indian Reservation, Arizona* discusses the district geology in detail. In 1988, the US Geological Survey's Uranium Resource Assessment Group, using the deposit-size-frequency method, suggested that the uranium endowment in the breccia pipe deposits of the Arizona Strip could be as much as eight times that reported in 1980. Therefore, this district has the potential to become the second biggest uranium district in the USA, following the San Juan Basin of New Mexico. USGS Circular 1051 summarizes the 1988 resource evaluation of the Arizona Strip district.

ISL projects, because of their generally low capital and operating costs, plus smaller-scale permitting requirements, have survived somewhat better than most conventional mining projects. A cadre of experienced production and exploration staff have built up the ISL industry, which is actively looking at known sandstone deposits as potential candidates for this new mining method. Two operators, Malapai Resources Company and Total Minerals Corporation, a wholly-owned subsidiary of Total Compagnie Française des Pétroles of France, have conducted most of the ISL drilling in the USA so far in 1990. Recently, Total performed due diligence work at the Malapai properties for Electricité de France who, together with Total, announced plans in late July to purchase Malapai's properties.

Ferret Exploration, with the support of German and Korean interests, did some development drilling on its Crow Butte project early in the year. This future production center has now acquired all necessary permits, and construction began earlier this year. No official announcement has been made about the actual date of production, but the project is expected to be able to start up early in 1991.

RAW MATERIALS

Possible Future Exploration

While little other ISL evaluation activity occurred in early 1990, the pace could increase later in the year. Uranerz Exploration and Mining (West Germany), after making a major investment in the Rabbit Lake uranium project in western Canada, has let it be known that all of its ISL properties in the USA are available for sale at the right price. Uranerz is closing its Casper, Wyoming office, and will in the future have only the Saskatoon, Saskatchewan and Denver, Colorado exploration offices in North America. However, the Denver office will focus on gold exploration.

Many uranium deposits that had been planned for conventional mining are now being reviewed for possible ISL exploitation. This process of resurrection and transformation is likely to generate additional drilling in the near term in New Mexico and Wyoming.

On June 1, 1990, Kennecott Corporation, a wholly-owned subsidiary of RTZ Corporation (UK), formed a 50/50 joint venture with US Energy Corporation of Riverton, Wyoming. Kennecott, of Salt Lake City, Utah, paid a total of \$15 million to US Energy, and will fund the first \$50 million of development work on the Green Mountain project in central Wyoming. Some drilling will probably be carried out on this site before the end of 1990.

Recent Closures and Shutdowns

Activity in most other areas involves retrenchment, reduction of land holdings, project closings, reclamation, and abandonment. The largest example of this type of activity in 1990 occurred in the San Juan Basin of

New Mexico, which had been the site of the largest uranium mines and mills in the USA. All production in the district has now ceased and the two major production centers are on standby awaiting better market conditions. The former Kerr-McGee complex, now owned by Rio Algom Mining Corporation (also ultimately controlled by RTZ Corporation) has been shut down since 1985, and Homestake Mining just recently ceased milling ores from Chevron's Mt. Taylor mine and from Homestake's Section 23 mine.

Both the Mt. Taylor and Section 23 mines are being allowed to flood, effectively removing those deposits from the marketplace for many years. Tennessee Valley Authority (TVA) has offered its properties for sale, plans to sell excess equipment, and has reduced the staff at its Casper, Wyoming field office. Pathfinder Mines is closing its St. George, Utah exploration office and moving part of the staff to Reno, Nevada, where the emphasis will be on gold. Cotter Corporation, wholly-owned by Commonwealth Edison, has put its Schwartzwalter underground mine on standby, but maintains a small office in Naturita, Colorado which will continue evaluation work in that district.

Conclusion

With these changes as a backdrop, US uranium exploration and development has deteriorated to its lowest level, and the degree of any recovery may depend almost wholly upon foreign interests. Nevertheless, a heartbeat is still detectable, and in general, the mining industry has a history of surprising resilience.

*Tom Pool
Bob Steele*

NUCLEAR INDUSTRY CALENDAR

1990

- Sept. 4-7** *International Seminar on the Costs and Financing of Nuclear Power in Developing Countries* (Jakarta, Indonesia). Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.
- Sept. 5-7** *Uranium Institute 15th Annual Symposium* (London, England). Contact the UI by facsimile at 071-225-0308.
- Sept. 13** *The New Currency: How to Capitalize on Air Emissions Credits* (Watergate Hotel, Washington, DC), sponsored by The Energy Daily. Contact Lissa Wilson at 1-202-662-9728.
- Sept. 13-14** *The Ninth Annual Nuclear Conference: "STANDARDIZATION: Can it Save the Nuclear Industry?"* (Stouffer Concourse Hotel, Washington, DC). Sponsored by McGraw-Hill Nuclear Publications. Contact McGraw-Hill at 1-800-223-6180 (in NY state: 212-512-6410).
- Sept. 16-19** *Uranium Seminar '90* (Hyatt Regency, San Antonio, Texas). Sponsored by the USCEA. Contact the USCEA Conference Office at 1-202-293-0770.
- Sept. 23-26** *AMC Mining Convention* (New Orleans, Louisiana). Contact American Mining Congress, Suite 300, 1920 N Street N.W., Washington, D.C. 20036, or facsimile 1-202-861-7535.
- Sept. 23-28** *ENC '90 Congress & Exhibition* (Lyon, France). Organized by the European Nuclear Society in collaboration with the ANS and Foratom. Contact Dr. P. Feuz, European Nuclear Society at 31-21 61 11.
- Oct. 14-16** *World Nuclear Fuel Market Annual Meeting* (Toulouse, France). Contact Donna Cason at 1-404-447-1144.
- Nov. 11-14** *Nuclear Energy Forum* (Washington Hilton, Washington, D.C.). Sponsored by the USCEA and ANS. Contact the USCEA Conference Office at 1-202-293-0770, or the ANS Meetings Department at 1-312-352-6611.
- Nov. 12-16** *First Regional Seminar for Europe and the Middle East on Quality Management for Nuclear Power Projects* (Prague, Czechoslovakia). Sponsored by the International Atomic Energy Agency. Contact Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.

1991

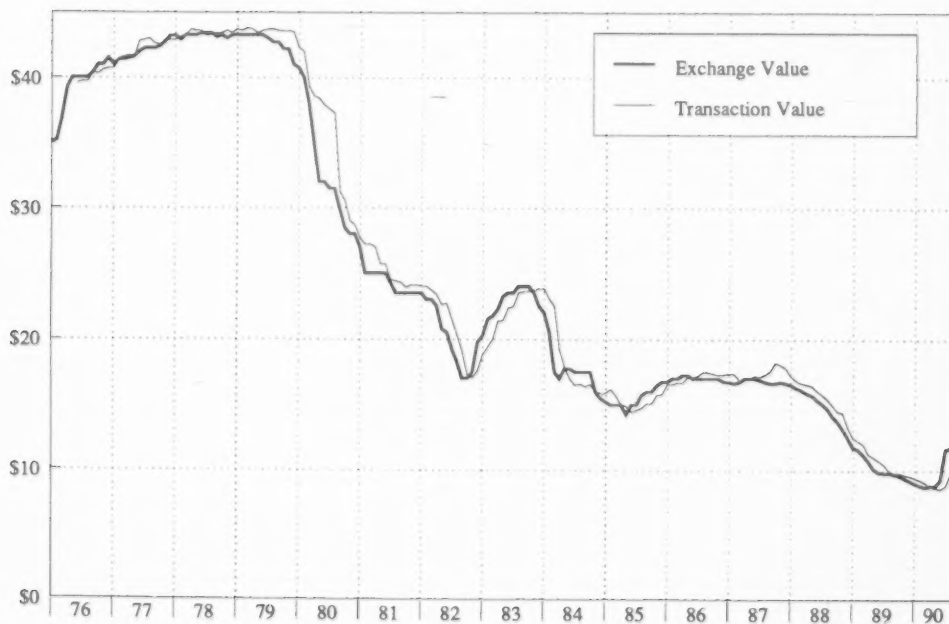
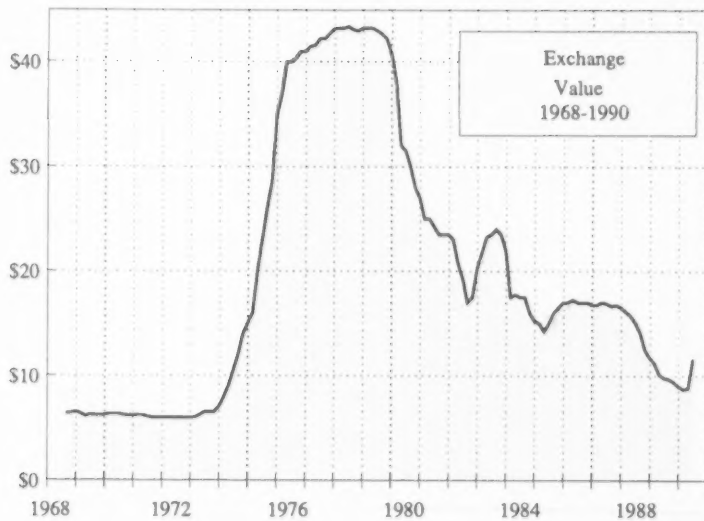
- April 14-18** *Third International Conference on Nuclear Fuel Reprocessing & Waste Management* (Sendai, Japan). Sponsored by the Atomic Energy Society of Japan and the Japan Atomic Industrial Forum, co-sponsored by the American Nuclear Society and the European Nuclear Society. Contact the Japan Atomic Industrial Forum at telephone 3-508-2411, or facsimile 3-508-2094.
- May 13-15** *Second International Conference on Transportation for the Nuclear Industry* (Bournemouth, England). Contact the Conference Secretary, The Institution of Nuclear Engineers, at 081-698 1500.



HISTORICAL MARKET DATA

**NUEXCO Historical
Exchange Value and
Transaction Value**

(In US Dollars per Pound Equivalent U3O8)



HISTORICAL MARKET DATA

HISTORICAL MARKET VALUES

EXCHANGE VALUES

Determined as of the last day of the month indicated (\$US/lb U₃O₈)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85	8.70	8.80	8.80	9.25	11.60	11.70					

US PREMIUM (Relative to the Exchange Value)

Determined as of the last day of the month indicated (\$US/lb U₃O₈)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	Discontinued	

HISTORICAL MARKET DATA

UF6 VALUES												
Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90	25.25	24.40	24.40	25.50	32.00	32.50					

US UF6 PREMIUM (Relative to the UF6 Value)												
Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	Discontinued	

TRANSACTION VALUES												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25	9.05	8.75	8.65	8.55	8.80	9.75					

HISTORICAL MARKET DATA
LOAN RATES

Determined as of the last day of the month indicated (Percent per Annum)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50	3.50	3.50	3.50	3.50	3.50	3.50					

* Float with Prime Rate

CONVERSION VALUES

Determined as of the last day of the month indicated (\$US/lb U as UF6)

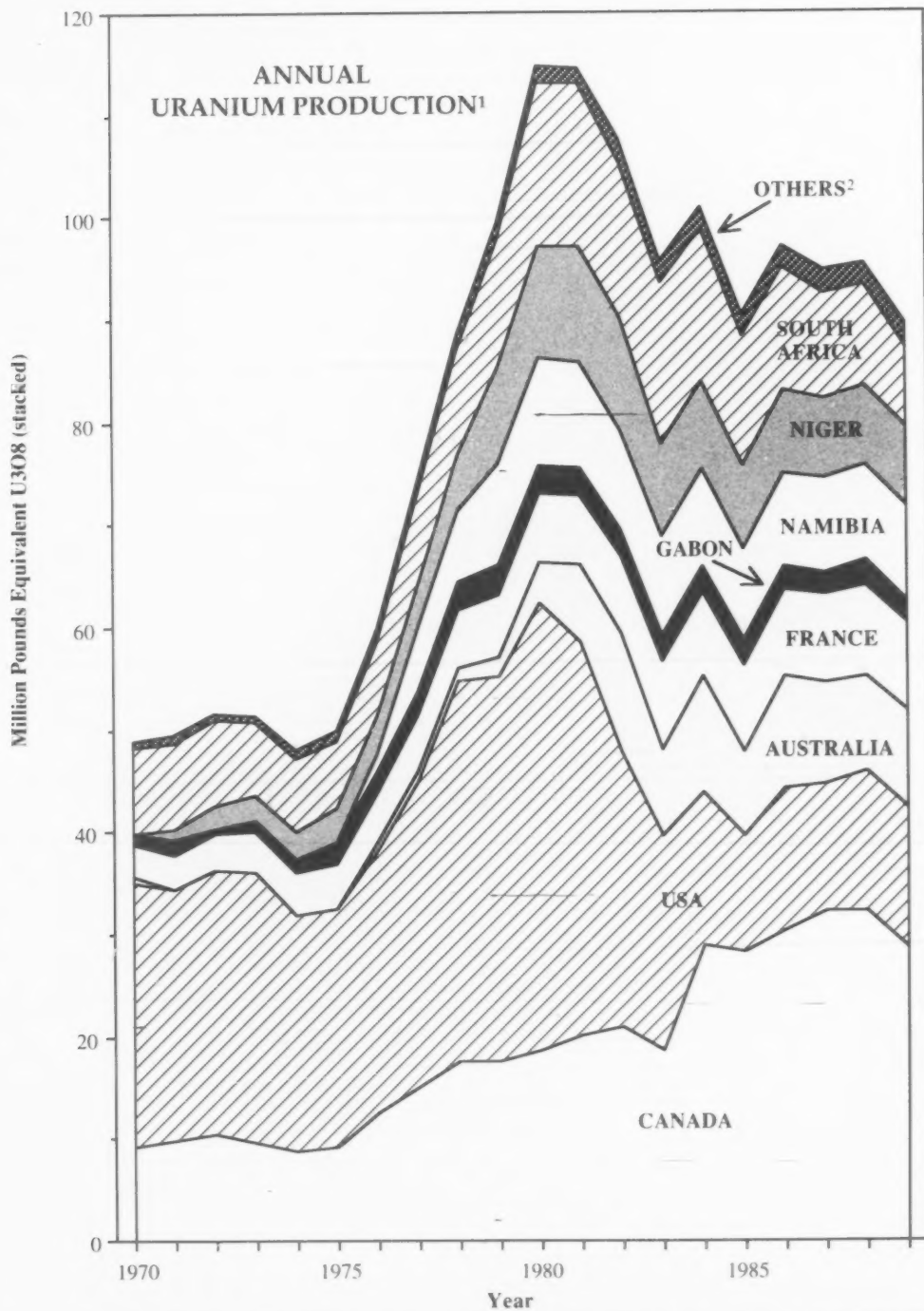
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.50	1.50	1.45	1.45	1.45	1.45	1.45					

SWU VALUES

Determined as of the last day of the month indicated (\$US per SWU)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54	50	50	50	50	50	50					

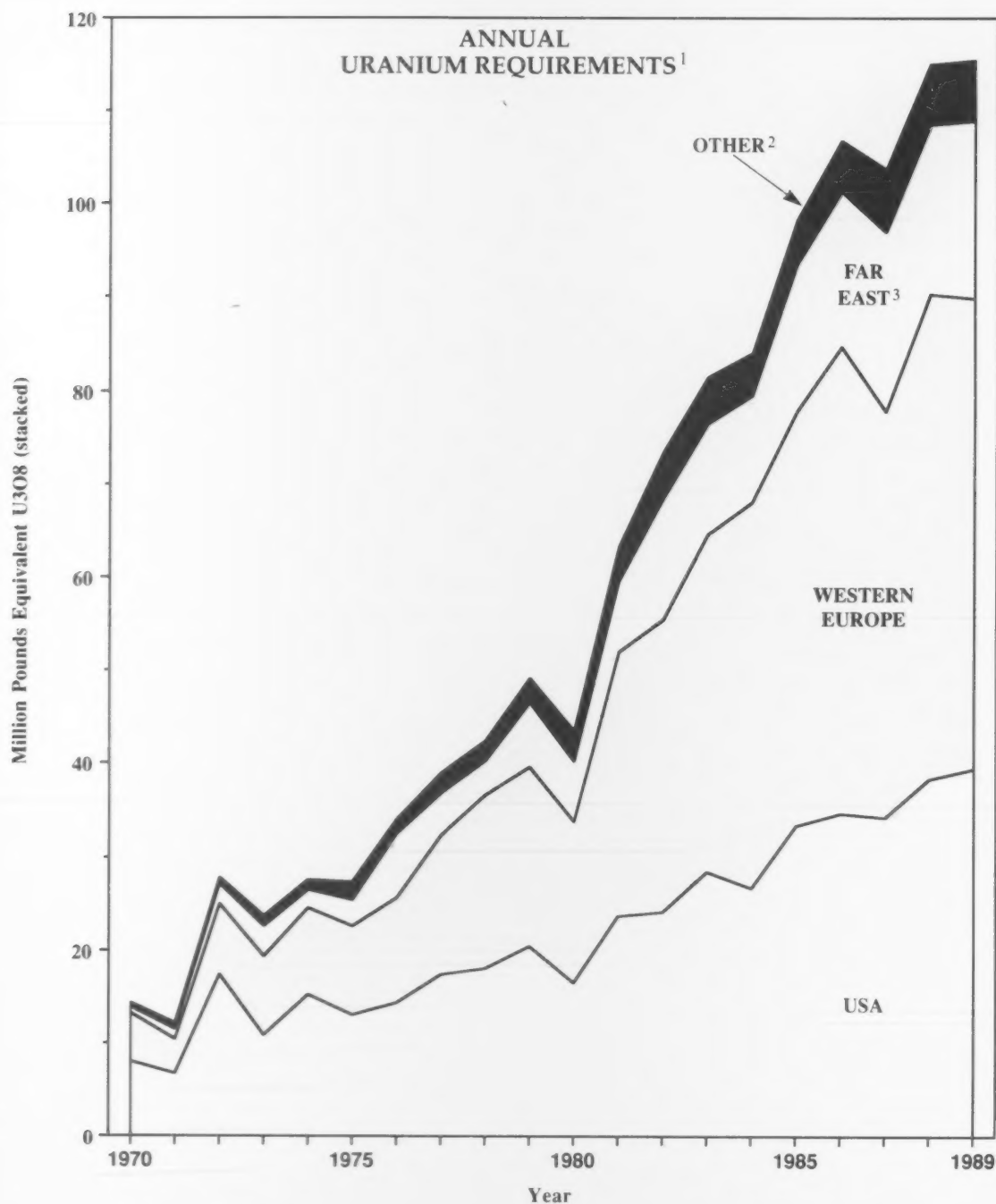
HISTORICAL MARKET DATA



¹ Estimated world production in 1989 totalled 89.6 million pounds (Australia—9.5; Canada—28.7; France—8.5; Gabon—2.2; Namibia—9.2; Niger—7.7; South Africa—7.7; USA—13.7; Others²—2.3).

² Others includes: Argentina, Belgium, Brazil, India, Pakistan, Portugal, Spain, West Germany and Yugoslavia

HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

² Other include: Argentina, Brazil, Canada, India, Mexico, Pakistan and South Africa.

³ Does not include Peoples Republic of China.

GOVERNMENT STATISTICS

AUSTRALIA					
Year	Period ¹	Consumer Price Index ² (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ³ (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia ⁴ (Australian dollars)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates ⁵ (June 1985=100)
1980	Avg.	95.8	83.1	—	140.8 ⁶
1981	Avg.	105.0	85.9	—	154.1 ⁶
1982	Avg.	116.7	89.0	—	174.9 ⁶
1983	Avg.	128.5	96.9	—	181.9 ⁶
1984	Avg.	133.6	98.0	—	194.4 ⁶
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
1989	Avg.	194.6	117.0	534.65	126.0
Jan	1989	—	110.6	—	123.3
Feb	1989	—	111.2	521.90	123.4
Mar	1989	188.0	114.9	—	125.0
Apr	1989	—	117.5	—	125.4
May	1989	—	118.6	530.40	125.6
June	1989	192.6	119.9	—	125.8
July	1989	—	120.1	—	126.9
Aug	1989	—	119.2	539.30	127.0
Sept	1989	197.0	117.7	—	127.1
Oct	1989	—	117.8	—	127.3
Nov	1989	—	118.0	547.00	127.7R
Dec	1989	200.7	118.2	—	128.0
Jan	1990	—	119.2	—	128.0
Feb	1990	—	120.8	—	128.0
Mar	1990	204.1	121.5	—	128.2
Apr	1990	—	119.9	—	128.5
May	1990	—	118.9	—	128.7

P = Preliminary **R** = Revised since last month

¹ Monthly data for the period 1967 to 1986 appears in Report 233 (January 1988).

² Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.

³ Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

⁴ Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

⁵ Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

⁶ Base: June 1976 = 100.

GOVERNMENT STATISTICS

CANADA								
Wage-earner Data: Average Hourly Earnings (C\$) ³								
		Industrial Products Price Index: All Commodities ¹ (1981 = 100)	Consumer Price Index: All Items (1986 = 100) ²	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	90.7	67.1	—	—	—	—	—
1981	Avg.	100.0	75.5	—	—	—	—	—
1982	Avg.	106.7	83.7	—	—	—	—	—
1983	Avg.	110.4	88.5	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	92.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	96.0	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	100.0	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	104.4	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	108.6	20.91	18.51	16.95	13.17	13.77
1989	Avg.	131.1	114.0	21.97	20.02	18.41	13.71	14.16
Jan	1989	130.7	110.8	21.22	19.45	18.14	13.75	13.82
Feb	1989	130.8	111.6	22.05	19.51	18.26	13.79	13.89
Mar	1989	131.3	112.1	21.90	19.65	18.35	13.62	14.10
Apr	1989	131.3	112.5	22.37	19.80	18.40	13.57	14.16
May	1989	131.4	113.6	21.89	20.02	18.17	13.76	14.27
June	1989	131.5	114.2	21.89	20.02	18.17	13.76	13.22
July	1989	131.4	115.0	21.67	19.60	17.96	13.57	12.98
Aug	1989	131.3	115.1	20.97	19.76	18.24	13.52	14.30
Sept	1989	131.0	115.2	21.97	20.61	18.73	13.68	14.83
Oct	1989	130.8	115.7	22.26	20.71	18.74	13.99	14.77
Nov	1989	130.8	116.0	22.60	20.64	18.78	13.93	14.75
Dec	1989	130.4	116.0	22.80	20.50	18.93	13.62	14.77
Jan	1990	130.8R	116.9	21.88	20.39	19.03	13.99	14.78
Feb	1990	131.6	117.6	22.51	20.63	19.14	14.49	15.03
Mar	1990	131.5R	118.0	22.52	20.75	19.17	14.99	15.07
Apr	1990	131.3R	118.1	23.17R	21.20R	19.46R	14.83R	14.93R
May	1990	131.8	118.7	23.28P	20.35P	18.94P	14.54P	15.10P
June	1990	131.7	119.2	—	—	—	—	—

P = Preliminary R = Revised since last month

¹Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

²New Base Year of 1986, as of Report 264. Previous Base Year was 1981. All figures in column recalculated by 0.755 multiplier.

³Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

GOVERNMENT STATISTICS

SOUTH AFRICA							
		Average Declared Working Costs per Metric Ton of Gold Ore Milled ¹ (Rand)	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled ² (March 1982 = 100)	Consumer Price Index ³ (1985 = 100)	Production Price Index All Groups ⁴ (1985 = 100)	Total Employment in Mining and Quarrying ⁵	Total Salaries and Wages in Mining and Quarrying ⁵ (1,000 Rand)
							Annual Total ⁶
1980	Avg.	35.53	—	51.9	55.2	709,042	2,237,689
1981	Avg.	41.89	—	59.8	62.7	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	71.4	702,441	3,181,584
1983	Avg.	51.88	115.0	77.1	79.0	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	85.6	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	100.0	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	119.5	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	136.2	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	154.1	705,355	7,774,054
1989	Avg.	116.65	273.0	178.2	177.5	700,360	8,833,934R
							Monthly Total
Jan	1989	—	—	166.8	165.5	714,593	704,320
Feb	1989	—	—	168.2	168.5	696,329	669,983
Mar	1989	112.29	262.8	170.9	171.1	702,746	695,843
Apr	1989	—	—	173.1	173.8	658,677	634,344
May	1989	—	—	175.9	176.4	706,056	721,263
June	1989	113.76	267.0	177.7	177.1	706,810	720,586
July	1989	—	—	179.3	178.8	711,648	775,002
Aug	1989	—	—	181.8	180.7	703,812	793,475
Sept	1989	119.76	280.2	183.4	181.7	708,222	780,723
Oct	1989	—	—	185.1	183.9	689,017	737,718R
Nov	1989	—	—	187.0	185.6	704,025	790,375
Dec	1989	120.79	282.0	189.4	187.2	702,382	810,302
Jan	1990	—	—	192.0	188.8	688,837	801,616
Feb	1990	—	—	193.3	190.3	674,026	767,274
Mar	1990	126.74	296.3	196.4	190.9	684,251	762,303
Apr	1990	—	—	198.3	194.1R	696,107	810,474
May	1990	—	—	200.4	196.3	—	—
June	1990	128.25	299.87	201.8	—	—	—
P = Preliminary R = Revised since last month							
¹ Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.							
² Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.							
³ Central Statistical Service, Pretoria: All income groups-weighted average, Historical Data by month appears in Report 236.							
⁴ Central Statistical Service, Pretoria: All commodities for consumption in South Africa.							
⁵ Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.							
⁶ Annual total is shown, rather than monthly average for indicated year.							

GOVERNMENT STATISTICS

UNITED STATES									
					Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴				
		Producer Price Index ¹		Consumer Price Index ²	GNP Implicit Price Deflator ³				
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
1989	Avg.	111.6	112.2	124.0	126.6	13.67	13.75	13.06	10.38
Jan	1989	109.4	110.5	121.1	—	13.80	13.49	12.85	10.27
Feb	1989	110.1	110.8	121.6	—	13.66	13.48	12.88	10.26
Mar	1989	110.5	111.5	122.3	125.4	13.71	13.51	12.91	10.30
Apr	1989	111.8	112.3	123.1	—	13.68	13.65	12.92	10.31
May	1989	112.1	113.2	123.8	—	13.60	13.57	12.98	10.33
June	1989	112.4	112.9	124.1	126.0	13.62	13.66	12.98	10.37
July	1989	112.2	112.8	124.4	—	13.70	13.75	13.12	10.41
Aug	1989	111.4	112.0	124.6	—	13.64	13.72	13.08	10.40
Sept	1989	111.9	112.4	125.0	126.8	13.70	13.99	13.18	10.47
Oct	1989	112.4	112.8	125.6	—	13.76	13.94	13.25	10.43
Nov	1989	112.2	112.7	125.9	—	13.69	14.12	13.26	10.47
Dec	1989	112.3	113.0	126.1	128.0	13.51	14.16	13.31	10.52
Jan	1990	114.1	114.9	127.4	—	13.75	13.95	13.31	10.50
Feb	1990	113.6	114.4	128.0	—	13.75	13.98	13.24	10.54
Mar	1990	113.2	114.2	128.7	129.7	13.85	14.04	13.30	10.58
Apr	1990	113.1	114.0	128.9	—	13.91R	14.32R	13.49R	10.58
May	1990	113.3	114.5	129.2	—	13.94P	14.15P	13.42R	10.62R
June	1990	113.1	114.2	129.9	130.9	—	—	13.46P	10.68P

P = Preliminary **R** = Revised since last month

¹US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

²US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average. All Items. Historical data is presented in Report 233.

³US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

⁴US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

GOVERNMENT STATISTICS

**VOLUME AND PRICE OF URANIUM DELIVERIES
TO THE EUROPEAN COMMUNITY¹**
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC ² (MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ³ Average Price		Spot Contracts ³ Average Price	
			in ECU per pound U ₃ O ₈	in US Dollars per pound U ₃ O ₈	in ECU per pound U ₃ O ₈	in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,500	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65	\$16.13
1989	13,500	11.5	ECU 26.63	\$29.35	ECU 11.04	\$12.19

R = Revised

¹ The twelve European Community member nations are Belgium, Denmark, France, West Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

² The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³ For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar. Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

GOVERNMENT STATISTICS

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	\$16.10	3.6	n/a	1.2
1977	29.9	27.8	\$19.75	5.6	n/a	4.0
1978	37.0	31.6	\$21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agents

³ Includes imports by domestic utilities and domestic suppliers

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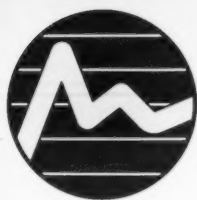
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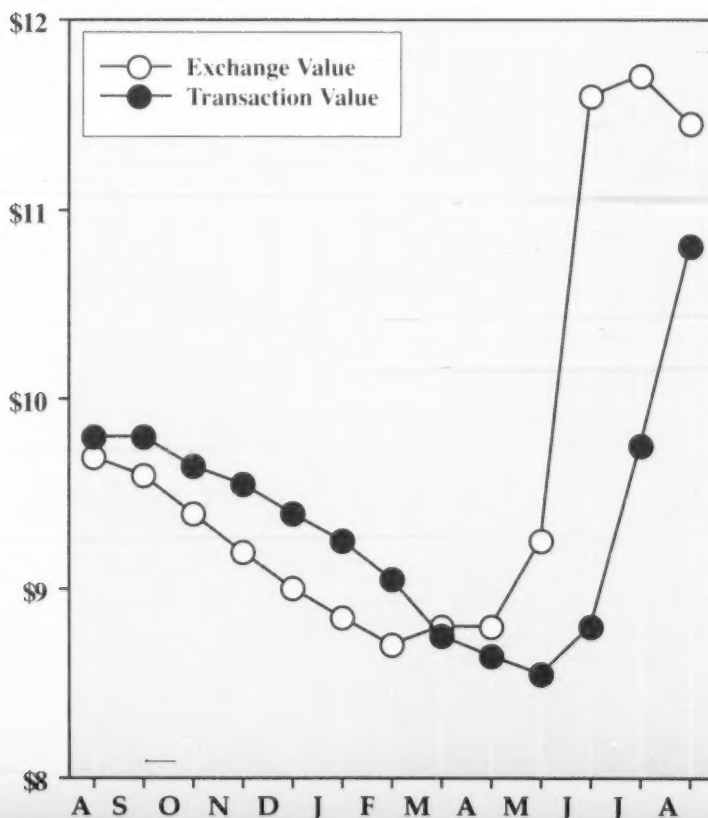


NUEXCO

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Monthly Report

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Annual Review;
Nuclear Fuel Market Study;
International Directory of
Nuclear Utilities (IDNU);
International Directory of
Uranium Producers (IDUP)

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• Electrical Energy Alternatives and Their Effect on the Environment — An essay by J. Robert Wolcott, chairman of NUEXCO's International Advisory Committee, discusses many of the issues prevalent in today's energy industry. All energy alternatives have pros and cons; so in this environmentally-conscious era, what direction should the United States choose?	
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• The Crow Butte Project Nears Production The Crow Butte Mining Project received its permit to construct from the Nebraska Department of Environmental Control on April 24, 1990, making it Nebraska's first uranium production project. The permit opened the way for commercial development of what is likely to be one of the USA's lowest-cost producers.	
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• Czechoslovakia's Nuclear Power and Fuel Programs Czechoslovakia has been one of Eastern Europe's most active uranium producers for more than 40 years and has an ambitious nuclear power program that extends into the 21st century. However, changing COMECON relationships, rapid internal political changes, capital constraints, and newly-expressed concerns about nuclear safety have left plans open to examination and alteration.	
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To Our Readers

The CONCORD/NUEXCO organization is pleased to announce that **Mr. Berwyn Edwards** has joined the CONCORD Group effective September 1, 1990. Berwyn is the former Head of the British Civil Uranium Procurement Organization (BCUPO). BCUPO is the division of the Nuclear Fuel Cycle Department of Nuclear Electric (formerly CEGB) responsible for managing all of the uranium requirements for the UK nuclear program.

Berwyn holds a Mechanical Engineering degree from the University of Wales. He also led the team that acquired the Highland uranium mine in 1989 for Power Resources Inc. (PRI)—a wholly-owned subsidiary of Nuclear Electric. Berwyn will be a Vice-President of CONCORD Resources, Ltd., and Office Director of Operations of CONCORD's London Office. He will be active in NUEXCO's nuclear fuel activities as well as some of CONCORD's other businesses.



* * *

NUEXCO will host a hospitality suite at the US Council for Energy Awareness' International Uranium Seminar 1990 to be held September 16-19 in San Antonio, Texas. We look forward to seeing you there.

MARKET REVIEW
MARKET VALUES SUMMARY

August 31, 1990

NUEXCO Market Values	This Report August 31, 1990	Last Report July 31, 1990	12 Months Ago August 31, 1989
EXCHANGE VALUE ¹	\$11.45/lb equivalent U ₃ O ₈	\$11.70	\$9.70
UF₆ VALUE ²	\$32.25/kg U as UF ₆	\$32.50	\$29.75
LOAN RATE ³	3.5% / annum	3.5%	3.5%
CONVERSION VALUE ⁴	\$1.45/lb U as UF ₆	\$1.45	\$1.90
SWU VALUE ⁵ (0.3 tails assay)	\$50/SWU	\$50	\$65
TRANSACTION VALUE ⁶	\$10.80/lb equivalent U ₃ O ₈	\$9.75	\$9.80
Transactions	27	35	15
Months	3	3	3
Millions of Pounds	5.5	9.1	2.1

DEFINITIONS

¹ The **Exchange Value** is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

² The **UF₆ Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

³ The **Loan Rate** is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

⁴ The **Conversion Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

⁵ The **SWU Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

⁶ The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:

- Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
- At least ten transactions;
- Transactions involving a sum total of at least 2 million pounds equivalent U₃O₈.

DERIVATIONS AND COMMENTS

• All **Market Values** are expressed in terms of US\$.

• All **Market Values** are based on:

- Data from recently completed transactions.
- Data from pending transactions.
- Firm bids to buy or borrow, and firm offers to sell or lend.
- Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend.

• Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these **Market Values**.

• In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers.

• The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.

• For the **SWU Value**, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the NUEXCO **Exchange Value** and **Conversion Value** determined as of the same date.

• In calculating the **Transaction Value**, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future **Exchange Values** or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined.

• The sample time for the **Transaction Value** is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

MARKET REVIEW

AUGUST MARKET REVIEW

(as of August 31, 1990)

OVERVIEW

August, often a slow month in the nuclear fuel market, was particularly slow this year. Only three natural uranium sales are reported, and near-term market volume fell short of one million pounds equivalent U_3O_8 for the first time since January. Moreover, no enriched or long-term uranium sales are reported.

The Exchange Value and the UF_6 Value each declined \$0.25, to \$11.45 per pound U_3O_8 and \$32.25 per KgU as UF_6 respectively, the first such decline since February of this year. The modest decline of the Exchange and UF_6 Values reflects the near-term softening of the uranium market. The Loan Rate, Conversion Value, and SWU Value all remain unchanged from their July 31 levels. Only two conversion sales, one loan, and one SWU sale are reported.

The August market volume of 800 thousand pounds equivalent U_3O_8 is less than one-fourth the average monthly volume over the previous 12 months. It is also the lowest monthly volume since the August 1989 level of 260 thousand pounds equivalent U_3O_8 . Year-to-date, near-term uranium sales volume, including a very large sale that was made earlier in the year, but which is only now being officially reported, now stands at nearly 33 million pounds equivalent U_3O_8 (Table 1). Thus, in only eight months, this year's spot and near-term uranium sales volume has set a new annual record.

NATURAL URANIUM AND CONVERSION

The August 31 **Exchange Value** declined slightly, to \$11.45 per pound U_3O_8 , down \$0.25 from the July 31 level of \$11.70 per pound U_3O_8 . This decline is the first drop in the Exchange Value since February 28, 1990. Although the record annual sales volume was surpassed in August, the level of market activity in August was low by any measure, particularly when compared to the hectic pace of the first half of the year. Market volume over the past twelve months has averaged 3.8 million pounds equivalent U_3O_8 per month, yet August's three uranium sales totalled only 800 thousand pounds equivalent U_3O_8 . Two of these sales involved concentrates, the other involved natural UF_6 . Buyers have largely completed their purchasing activity, so demand has declined significantly. And as higher prices have brought more supply into the market, the upward pressure on the Exchange Value has subsided and the market has softened somewhat.

One additional spot sale is reported this month, although it took place earlier in the year. An Australian producer sold its entire stockpile of inventory—in the form of concentrates—to a European intermediary. This is only being reported now that much of the previously proprietary information has been made public. This sale is not included in August's market totals because it occurred earlier in the year, but the year-to-date information in Table 1 has been updated to reflect this transaction.

No long-term uranium sales are reported for August.

* * *

The UF_6 Value decreased \$0.25, to \$32.25 per KgU as UF_6 , marking the first time in five months that the UF_6 Value has declined. As in the concentrates market, lack of demand and ample supply characterize the UF_6 market. In the only UF_6 sale reported, a US utility purchased a moderate quantity of UF_6 from an intermediary at a price near the August 31 UF_6 Value.

Table 1
NEAR-TERM URANIUM SALES SUMMARY

	August 1990		Year-to-Date	
	No. of Sales	Volume ¹	No. of Sales	Volume ¹
Concentrates	3	0.8	47	19.1
Natural UF_6			27	9.5
EUP			9	4.2
Total	3	0.8	83	32.8

¹ Million Pounds Equivalent U_3O_8

MARKET REVIEW

Table 2
NEAR-TERM SUPPLY/DEMAND SUMMARY

	Active Supply ¹	Active Demand ¹
• Natural Uranium ² (thousand lbs equivalent U ₃ O ₈)	5,400	830
• Supply/Demand Ratio:	6.5	
• Loan (thousand lbs equivalent U ₃ O ₈)	7,345	0
• Conversion (thousand lbs U as UF ₆)	0	400
• SWU (thousand SWUs)	435	75

¹ Supply and demand tables in the current market data section of this Report provide details for each category.
² Includes concentrates and hexafluoride.

The **Transaction Value** increased for the third consecutive month, to **\$10.80** per pound U₃O₈, based on 27 transactions over three months involving 5.5 million pounds equivalent U₃O₈. This \$1.05 increase is the largest absolute increase in the Transaction Value since July 1983. The increase came about largely because the lower-priced transactions from May no longer fall within the three-month time frame used when calculating the Transaction Value. The high volume of May's lower-priced transactions had heavily influenced previous Transaction Value calculations, reducing the increases of June 30 and July 31. The large spot sale of concentrates from earlier in the year is not included in the August 31 Transaction Value calculation because it falls outside the qualifying time period (June through August).

Active uranium supply decreased slightly to **5.4** million pounds equivalent U₃O₈, but it still remains well above **active uranium demand** of **830** thousand pounds

equivalent U₃O₈ (Table 2). The resultant **supply/demand ratio** is **6.5**. The abundance of uranium supply in the form of both concentrates and UF₆, and the significant easing of demand, acted together to weaken the market somewhat, so market prices have subsided from their recent peaks. Further adjustment may occur as market participants recognize and react to this supply abundance.

The **Loan Rate** remains at **3.5** percent per annum. Only one loan is reported for August; a US utility lent over one million pounds equivalent U₃O₈ for return in 1991, at a rate near the August 31 Loan Rate. Loan supply remains plentiful, contributing additional material to the prevailing abundance of supply.

The **Conversion Value** is unchanged at **\$1.45** per pound U as UF₆. The two August conversion sales totalled over one million pounds U as UF₆. One sale involved a US utility buyer; in the other, a European utility bought from a European intermediary. Both sales transpired at levels near the August 31 Conversion Value. While conversion supply is shown as zero in Table 2, ample UF₆ remains available for deconversion.

After five successive months of UF₆ selling at more than a dollar discount from the sum of the values of its components—concentrates and conversion—that discount has now fallen to \$0.86 per KgU as UF₆, the smallest since February. Although UF₆ remains plentiful, the large oversupply typical of the first half of the year has abated. Without a large oversupply of UF₆, and with the now ample supplies of concentrates, the downward pressure on the Conversion Value has dissipated. However, the balance between UF₆ and concentrates has not shifted far enough to create any significant upward pressure on the Conversion Value in the near-term.

MARKET REVIEW

**ENRICHMENT SERVICES AND
ENRICHED URANIUM PRODUCT**

The August 31 **SWU Value** is also unchanged, remaining at \$50 per SWU for the seventh consecutive month. Only one SWU sale is reported. This sale of a moderate quantity of SWU, from a European intermediary to a US utility, calls for delivery in 1991. SWU supply remains plentiful, especially SWU contained in EUP (enriched uranium product).

Recently, some buyers have entered the enrichment services market with special timing needs. These buyers needed SWU, but were unable to give sellers the standard 180-day lead time. As is often the case, such requests can be difficult to fill, and a premium SWU price usually is necessary to meet such a need. However, competition in the secondary enrichment market has created enough opportunities such that shorter lead-times can occasionally be accommodated. ■

**Table 3
ENRICHMENT PRICES
(August 31, 1990)**

Prices	This Month Report 265	Last Month Report 264	12 Months Ago Report 253
NUEXCO SWU Value (US \$ per SWU)	50	50	65
US DOE SWU prices: (US \$ per SWU)			
USEC	117.85 ¹	117.85 ¹	117.00 ²
AFC	153.00 ³	153.00 ³	153.00 ³
Requirements	157.00 ³	157.00 ³	157.00 ³
Incentive Price (IP1)	90.00 ⁴	90.00 ⁴	90.00 ⁴
Calculated worth of enriched UF₆: (US \$ per KgU as UF ₆)			
2.0 w/o U ₂₃₅	222	225	232
2.5 w/o U ₂₃₅	304	308	323
3.0 w/o U ₂₃₅	389	393	417
3.5 w/o U ₂₃₅	475	480	512
4.0 w/o U ₂₃₅	562	568	609
4.5 w/o U ₂₃₅	650	657	707

¹ Effective 10/1/89 to 9/30/90.
² Effective 10/1/87 to 9/30/89.
³ Effective since 10/1/84.
⁴ Effective 10/1/86 to 9/30/90, for up to 30% of annual requirements.
⁵ Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 w/o tails assay.

RECENT TRANSACTIONS

Uranium Sales ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U ₃ O ₈)	Price Within Percentage Range ² of Current Exchange or UF ₆ Value	Buyer	Seller	Remarks
4925	1990	101-300	103-110	Intermediary	Producer	
4928	1990-1991	301-600	R	Utility	Producer	
4930	1990	6,001-10,000	R	Intermediary	Producer	Occured earlier in 1990
4931	1991	50-100	98-102	Utility	Intermediary	UF ₆
Natural Uranium Loans ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U ₃ O ₈)	Price Within Percentage Range ² of Current Loan Rate	Borrower	Lender	Remarks
4938	1990	1,001-3,000	98-102	R	Utility	
Conversion Sales ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U equivalent)	Price Within Percentage Range ² of Current Conversion Value	Buyer	Seller	Remarks
4927	1991	301-600	98-102	Utility	R	
4937	1991	601-1,000	90-97	Utility	Intermediary	
Enrichment Sales ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity ³ (thousand SWU)	Price Within Percentage Range ² of Current SWU Value ⁴	Buyer	Seller	Remarks
4933	1991	50-100	103-110	Utility	Intermediary	
R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality. ¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information. ² The ranges <i>Below 90, 90-97, 98-102, 102-110, Above 110</i>, represent percentages (rounded to whole numbers) of the appropriate current Market Value. The endpoints of each range are included within that range. ³ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 % tails assay. ⁴ Prices are usually normalized to 0.30 % tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.						



MARKET REVIEW

SUPPLY AND DEMAND

Uranium Supply				
NUEXCO Project Number	Quantity (Thousand Pounds equivalent U ₃ O ₈)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Available for Sale				
ACTIVE				
89-1001*	1,305	--	1991	UF ₆
89-1180	350	--	1990	
90-1078A	2,175	2,175 per year	1991-1993	UF ₆
90-7001*	1,000	1,000 per year	1991-1995	
90-1183	70	--	1990-1991	
90-1200*	500	--	1990	
Total	5,400			
INACTIVE				
	500			
Available for Loan				
ACTIVE				
88-1182	4,000	--	--	U ₃ O ₈ /UF ₆
90-1016	300	--	--	U ₃ O ₈
90-1033	1,270	--	--	UF ₆
90-1108	1,000	--	--	U ₃ O ₈
90-1110	250	--	--	U ₃ O ₈
90-1180	525	--	--	U ₃ O ₈
Total	7,345			
INACTIVE				
	1,390			
* New or revised since last month.				
¹ For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.				
² For delivery beyond one year, measured from the date of this Report.				
Active Projects reclassified as Inactive since last month: 90-1115.				
Active Projects removed since last month: 90-1173.				

MARKET REVIEW

SUPPLY AND DEMAND

Uranium Demand				
NUEXCO Project Number	Quantity (Thousand Pounds equivalent U ₃ O ₈)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Inquiries to Purchase:				
ACTIVE				
90-1100A	45	--	1991	UF ₆
90-1177A	260	--	1991	UF ₆
90-1182	25	--	1991	
90-1199*	500	--	1990	U ₃ O ₈ /UF ₆
90-1098	--	250 per year	1992-1994	
90-1155	--	325 per year	1991-1995	
90-1170	--	290	1992-1996	
Total	830			
INACTIVE	2,080			
Inquiries to Borrow	No inquiries to borrow are reported			
* New or revised since last month. ¹ For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts. ² For delivery beyond one year, measured from the date of this Report. Active Projects removed since last month: 90-1113, 90-1171.				



MARKET REVIEW

SUPPLY AND DEMAND

Conversion Supply And Demand			
NUEXCO Project Number	Quantity (Thousand Pounds U as UF ₆)		Remarks
	Within 3 Years ¹	Beyond 3 Years ¹	
Available for Sale	No offers to sell are reported		
Inquiries to Purchase			
ACTIVE			
90-1184	400	--	
Total	400		
INACTIVE			
		None reported	
* New or revised since last month. ¹ Measured from the date of this Report. Projects removed since last month: none.			

MARKET REVIEW

SUPPLY AND DEMAND

SWU Supply And Demand				
NUEXCO Project Number	Quantity (Thousand SWUs)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Available for Sale				
ACTIVE				
90-1078B	435	435 per year	1991-1993	UF _{6e}
90-7000	--	1,000	1991 on	
Total	435			
INACTIVE				
	None reported			
Inquiries to Purchase				
ACTIVE				
90-1100B	15	--	1991	UF _{6e}
90-1177B	60	--	1991	UF _{6e}
88-1061	--	500	1991-1995	
90-1076	--	350 per year	1992-1998	
90-1094	--	500	1992-2000	
90-1144	--	60 per year	1992-2001	
90-1181	--	600	1996-2003	UF _{6e}
90-1196*	--	60 per year	1995 on	
Total	75			
INACTIVE				
	1,645			
* New or revised since last month.				
¹ For delivery within one year, measured from the date of this Report. This category excludes SWU deliverable within one year under other than spot or near-term contracts.				
² For delivery beyond one year, measured from the date of this Report.				
Projects removed since last month: none.				

MARKET REVIEW

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

Exchange Value ¹						
Country (currency)	per lb equivalent U308 as Concentrates			per kg U as Concentrates		
	This Month (Aug. 31, 1990)	Last Month (July 31, 1990)	12 Months Ago (Aug. 31, 1989)	This Month (Aug. 31, 1990)	Last Month (July 31, 1990)	12 Months Ago (Aug. 31, 1989)
Australia (dollar)	13.98	14.78	12.67	36.35	38.42	32.93
Belgium (franc)	368.29	386.27	396.08	957.46	1,004	1,030
Canada (dollar)	13.13	13.48	11.42	34.14	35.06	29.70
EEC (ecu)	8.68	9.11	9.05	22.56	23.68	23.52
Finland (markka)	42.22	44.06	42.71	109.77	114.54	111.04
France (franc)	60.12	62.83	63.82	156.29	163.34	165.91
Italy (lira)	13,294	13,747	13,593	34,561	35,739	35,339
Japan (yen)	1,652	1,732	1,399	4,294	4,502	3,638
Netherlands (guilder)	20.21	21.18	21.36	52.54	55.05	55.52
So. Africa (comm. rand)	29.32	30.41	26.64	76.23	79.07	69.26
Spain (peseta)	1,118	1,154	1,185	2,907	3,001	3,082
Sweden (krona)	65.96	68.50	64.03	171.47	178.09	166.45
Switzerland (franc)	14.83	15.91	16.33	38.56	41.35	42.45
UK (pound)	5.97	6.33	6.15	15.52	16.46	15.99
US (dollar)	11.45	11.70	9.70	29.77	30.425	25.22
West Germany (mark)	17.94	19.46	18.94	46.63	50.59	49.23

Transaction Value ¹						
Country (currency)	per lb equivalent U308 as Concentrates			per kg U as Concentrates		
	This Month (Aug. 31, 1990)	Last Month (July 31, 1990)	12 Months Ago (Aug. 31, 1989)	This Month (Aug. 31, 1990)	Last Month (July 31, 1990)	12 Months Ago (Aug. 31, 1989)
Australia (dollar)	13.19	12.32	12.80	34.28	32.02	33.27
Belgium (franc)	347.38	321.89	400.16	903.11	836.84	1,040
Canada (dollar)	12.39	11.24	11.54	32.21	29.21	30.00
EEC (ecu)	8.18	7.59	9.14	21.28	19.73	23.76
Finland (markka)	39.82	36.71	43.15	103.53	95.45	112.19
France (franc)	56.70	52.36	64.47	147.42	136.12	167.62
Italy (lira)	12,539	11,456	13,733	32,599	29,782	35,703
Japan (yen)	1,558	1,443	1,414	4,050	3,751	3,675
Netherlands (guilder)	19.06	17.65	21.58	49.55	45.88	56.09
So. Africa (comm. rand)	27.66	25.34	26.92	71.90	65.89	69.97
Spain (peseta)	1,055	961.82	1,198	2,742	2,501	3,114
Sweden (krona)	62.21	57.08	64.69	161.74	148.41	168.17
Switzerland (franc)	13.99	13.25	16.50	36.37	34.46	42.89
UK (pound)	5.63	5.28	6.21	14.64	13.72	16.16
US (dollar)	10.80	9.75	9.80	28.08	25.35	25.48
West Germany (mark)	16.92	16.21	19.13p	43.98	42.16	49.74

¹ Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

MARKET REVIEW

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

CONVERSION VALUE¹

Country (currency)	per lb U as UF ₆			per kg U as UF ₆		
	This Month (Aug. 31, 1990)	Last Month (July 31, 1990)	12 Months Ago (Aug. 31, 1989)	This Month (Aug. 31, 1990)	Last Month (July 31, 1990)	12 Months Ago (Aug. 31, 1989)
Australia (dollar)	1.77	1.83	2.48	3.90	4.04	5.47
Belgium (franc)	46.64	47.87	77.58	102.82	105.54	171.04
Canada (dollar)	1.66	1.67	2.24	3.67	3.68	4.93
EEC (ecu)	1.10	1.13	1.77	2.42	2.49	3.91
Finland (markka)	5.35	5.46	8.37	11.79	12.04	18.44
France (franc)	7.61	7.79	12.50	16.78	17.17	27.56
Italy (lira)	1.684	1.704	2.663	3.711	3.756	5.870
Japan (yen)	209.17	214.59	274.09	461.15	473.09	604.27
Netherlands (guilder)	2.56	2.62	4.18	5.64	5.79	9.22
So. Africa (comm. rand)	3.71	3.77	5.22	8.19	8.31	11.50
Spain (peseta)	141.59	143.04	232.19	312.15	315.35	511.89
Sweden (krona)	8.35	8.49	12.54	18.41	18.72	27.65
Switzerland (franc)	1.88	1.97	3.20	4.14	4.35	7.05
UK (pound)	0.76	0.78	1.20	1.67	1.73	2.66
US (dollar)	1.45	1.45	1.90	3.20	3.20	4.19
West Germany (mark)	2.27	2.41	3.71	5.01	5.32	8.18

SWU VALUE AND UF₆ VALUE¹

Country (currency)	SWU Value at 0.30% Tails Assay			UF ₆ Value per kg U as UF ₆		
	This Month (Aug. 31, 1990)	Last Month (July 31, 1990)	12 Months Ago (Aug. 31, 1989)	This Month (Aug. 31, 1990)	Last Month (July 31, 1990)	12 Months Ago (Aug. 31, 1989)
Australia (dollar)	61.05	63.16	84.89	39.38	41.05	38.85
Belgium (franc)	1.608	1.651	2.654	1.037	1.073	1.215
Canada (dollar)	57.35	57.62	76.54	36.99	37.46	35.03
EEC (ecu)	37.89	38.92	60.62	24.44	25.30	27.74
Finland (markka)	184.37	188.27	286.22	118.92	122.38	130.99
France (franc)	262.52	268.50	427.63	169.33	174.52	195.72
Italy (lira)	58,052	58,748	91,087	37,443	38,186	41,690
Japan (yen)	7,213	7,400	9,377	4,652	4,810	4,292
Netherlands (guilder)	88.25	90.50	143.11	56.92	58.82	65.49
So. Africa (comm. rand)	128.04	129.97	178.52	82.59	84.48	81.70
Spain (peseta)	4,882	4,932	7,943	3,149	3,206	3,636
Sweden (krona)	288.02	292.74	429.04	185.77	190.28	196.36
Switzerland (franc)	64.78	67.97	109.43	41.78	44.18	50.08
UK (pound)	26.07	27.06	41.22	16.81	17.59	18.86
US (dollar)	50.00	50.00	65.00	32.25	32.50	29.75
West Germany (mark)	78.32	83.15	126.90	50.52	54.05	58.08

¹ Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

RECENT DEVELOPMENTS

RECENT DEVELOPMENTS

USA

Isotope Technologies Announces New Partners

On August 20, Isotope Technologies, Inc. (ITI) announced the formation of a joint venture with two Canadian partners—Cameco, the world's largest uranium producer, and Agra Industries, Ltd., an architectural/engineering firm—both of which are based in Saskatoon, Saskatchewan. The new venture, called CRISLA Technologies, is also based in Saskatoon. It utilizes ITI-developed CRISLA technology (chemical reaction by isotope selective laser activation) to chemically enrich uranium. CRISLA Technologies will conduct its research at Cameco's facilities with engineering support provided by Agra; marketing efforts will remain based in California at ITI headquarters.

This announcement marks the movement of CRISLA R&D into the technology demonstration phase. The new company hopes to build a commercial-scale 1000-SWU module by 1992. After the process has been demonstrated and verified, the company plans to build a pilot plant, adding modules to reach an annual production capacity of

100,000 SWU. The partners' long-range plans call for a 250–500 thousand SWU per year capacity. John Longenecker, President of ITI, projects development costs of \$50 million for the first SWU module through initial production. Cameco and Agra will match the investment ITI has made to date.

One benefit of Cameco's participation is that this technology is ideally suited to the back end of a conversion plant. By locating an enrichment plant at a conversion plant, it eliminates the need to transport hazardous UF₆, and also allows the fluorine used in the enrichment process to be recycled into the conversion process. Another advantage is that by locating the enrichment facility at an existing, licensed site in Canada, CRISLA Technologies may succeed in demonstrating the technology sooner.

John Longenecker and William Pearson, Vice President for Agra's engineering group, will serve as Directors of CRISLA Technologies, and Bernard Michel, Cameco's Executive Vice President, will be Chairman. Dr. Dennis G. Garratt of Cameco has been appointed Project Manager. ■

WASHINGTON FOCUS

Congress was in recess during August, but some developments occurred in other branches of the US government. The President's Commission on Catastrophic Nuclear Accidents issued a report with recommendations to Congress regarding the Price-Anderson Act. The Congressional Budget Office released its preliminary estimate of the FY90 budget deficit, and if Congress does not reach agreement on a budget, cuts required by the Gramm-Rudmann Act could cause major problems for DOE. DOE has also asked Congress to reconsider, after turning down a request in July, reprogramming \$20 million from the uranium enrichment account to other account. President Bush signed the Customs and Trade Act of 1990, which may reduce the cost of importing nuclear fuel.

Presidential Commission Issues Report

The President's Commission on Catastrophic Nuclear Accidents issued a report that includes recommendations to Congress for several changes in the compensation procedures for claims relating to accidents covered by the Price-Anderson Act. The Price-Anderson Act provides tertiary coverage to the public in case of a major nuclear accident. It outlines provisions for compensation to victims of a nuclear accident beyond the coverage provided by the individual utility (primary) and by the entire industry (secondary). For example, the Commission recommends that claims should be handled by a judicial system, rather than an administrative system. A second recommendation is a no-fault claim system, whereby anyone developing cancer after exposure to a nuclear accident would be compensated, regardless of whether proof exists that the cancer resulted from that exposure.

FY90 Budget Deficit Troublesome for DOE

The Congressional Budget Office has released its initial estimate of the US government's FY90 deficit. This deficit estimate could cause DOE to face a 32.4 percent across-the-board reduction in spending authority under the Gramm-Rudman Act's authority to sequester accounts. If the sequester takes place, the uranium enrichment account would be cut by approximately \$400 million. These cuts would reduce government revenue, lead to staff reductions, and could postpone the AVLIS R&D program. According to DOE's enrichment program budget officer, the potential damage from such a sequester makes it an "unimaginable cut." Upon returning in September, Congress is likely to vote to ignore, or somehow weaken, the requirements of the Gramm-Rudman Act. With Congressional elections upcoming in November, Congress will be reluctant to make tough decisions about reducing the budget deficit.

DOE Asks Congress to Reconsider Reprogramming Request

DOE requested that Congress reconsider its decision not to allow a reprogramming of \$20 million from the uranium enrichment account to accounts for advanced reactor research, waste disposal research, and the restart of the Savannah River defense facility. (Congress denied the original request last month.) DOE Comptroller Elizabeth Smedley wrote to reassure Congress that the uranium enrichment account has adequate funds, and would not suffer from the requested reprogramming. "The department currently has over \$700 million in balances which would be available to the

RECENT DEVELOPMENTS

President Signs Customs and Trade Act

new corporation." This \$700 million has never been itemized in the uranium enrichment account before, but has existed by Congressional concurrence that funds for the new government corporation need to be set aside. However, compared to the expected operating costs, \$700 million is only a small portion of what will be required. According to a Congressional staffer, the proposed corporation will need \$100-\$150 million per month for operating expenses, in addition to the demand charge payments that must be made to TVA. Congress may act on the reprogramming request when it returns in September.

On August 20, President Bush signed the Customs and Trade Act of 1990, which will bring customs-user fees into compliance with the General Agreement on Tariffs and Trade (GATT). Effective October 1, the new fee schedule imposes a ceiling of \$400 for each entry, with a minimum fee of \$21. As required by GATT, fees charged will approximate the cost of services rendered. This Act will reduce the cost of importing nuclear fuel, but the savings may be offset by a potential increase in the harbor maintenance fee.

INDUSTRY BRIEFS

Bechtel, Westinghouse And Consumers Form Joint Venture To Operate Palisades

After nearly three years of negotiations, Consumers Power Co. has agreed to sell a 55-percent interest in its Palisades nuclear power plant to Westinghouse Electric Co. and Bechtel Power Corp. Westinghouse will invest \$20 million for a 22-percent interest, and Bechtel will invest \$30 million for a 33-percent interest. The three companies will form a partnership, Palisades Generating Co., to own and operate the plant as an independent power producer (IPP). The deal should close early in 1991.

Westinghouse will acquire only 4.9 percent of the voting rights, thereby avoiding the five-percent level that would restrict its involvement in similar arrangements in other states. Consumers Power will manage the 760-MWe South Haven, Michigan plant and purchase its output.

The Michigan Public Service Commission is contesting the planned sale of the plant to the IPP partnership, because the sale would eliminate the commission's jurisdiction over consumer rates. The Federal Energy Regulatory Commission has jurisdiction over consumer rates for IPP-generated electricity, and has commonly been more generous to utilities than have state commissions.

British Government To Sell PowerGen In Public Offering

Continuing the move toward privatization of Britain's electrical power generation, the British government has terminated talks with Hanson PLC about the sale of state-owned PowerGen. PowerGen is one of Britain's two non-nuclear electricity generating companies. On August 23, Energy Secretary John Wakeham indicated that the government had decided to return to its original plan to sell PowerGen to the public, rather than to Hanson PLC, a private firm, because the public sale could raise in excess of £1.1 billion.

♦ ♦ ♦

NPT Conference Opens In Geneva

The fourth review conference of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) opened in Geneva, Switzerland on August 20, and is scheduled to conclude on September 14. This conference is important because it is the last meeting before the 1995 conference, which must decide whether to extend the NPT (and if so, for how long). Two nuclear weapons states, France and China, have not signed the NPT, but have asked for the first time to attend the review conference as observers.

Soviets Buy US Computers For Nuclear Safety

The US government and the 17-nation Coordinating Committee for Multilateral Export Controls have approved the Soviet Union's \$32-million purchase of six Control Data Corp. computers, for use in nuclear power plant safety research and development. The computers are six times more powerful than any previously sold to the Soviet Union. Although stringent safeguards to prevent military use are conditions of the sale, it is still an important indicator of improving US-Soviet relations, and a major step in assisting the Soviet Union in improving its nuclear power plant safety. The first shipments are scheduled for September 1990.

♦ ♦ ♦

Cameco Completes Sale Of Interest In Rabbit Lake

On July 25 in Bonn, West Germany, Cameco completed its sale to Uranerz Exploration and Mining, Ltd. (a Canadian subsidiary of Bonn-based Uranerzbergbau GmbH) of a one-third interest in Cameco's Rabbit Lake Mill, and Collins Bay and Eagle South deposits. The C\$160 million sale followed an agreement reached between the two companies on April 2, 1990 (April Monthly Report #260, p. 20). Uranerz already shared interests with Cameco in the Key Lake facilities and Eagle North deposits.

RECENT DEVELOPMENTS

**Ebasco And CEGA Each Win
Defense Reactor Contract**

DOE announced it will award two design contracts worth \$1.5 billion each; one to Ebasco Services and one to CEGA, Inc. The contracts involve replacing the reactors used to generate tritium at the Savannah River facility. Westinghouse did not win a contract—its Eagle 2000 HWR design met all criteria, but the design was unproven and would have required a complex refueling procedure. The Ebasco and CEGA designs use a greater number of proven technologies, and DOE concluded those designs would result in a more reliable projections of operating dates. DOE estimates the cost to complete the two reactors is \$7.7 billion.

CEGA, a joint company of ABB-Combustion Engineering and General Atomics, designed a Modular Helium Reactor (MHR) that shares over three-fourths of its components with GA's civilian MHR design. Ebasco, a subsidiary of Enserch Corp., submitted an HWR design. Improved US-Soviet relations have Congress calling into question many defense expenditures, so uncertainty exists as to whether Congress will approve the design engineering work for two separate designs, or if it will approve the construction of any defense reactors.

**East German Utility
Takeover Settled**

Several companies and government officials have reached a preliminary agreement on the future of East Germany's electrical generation industry. The initial plan, proposed by West Germany's three largest utilities, Bayenwerk AG, Preussenelektra AG, and RWE AG (August Monthly Report #264, p. 20), was turned down in August by the East German Parliament and anti-cartel authorities in both East and West Germany. Following this denial, the three utilities initiated new discussions with East German authorities. The new agreement will permit other interested parties to participate. Details are still being negotiated. When finalized, the agreement will clear up one more matter from the many issues that need to be resolved before the October 3, 1990 unification date that the two Germanies announced this month.

♦ ♦ ♦

**Rio Algom Shuts Down
Quirke And Panel Early**

Rio Algom announced in late July that production at its Quirke and Panel uranium mines would cease at the end of August. An earlier announcement (February Monthly Report #258, p. 18) stated production was to cease in early 1991. Rio Algom has applied to the Atomic Energy Control Board for decommissioning licenses for the two mines.

**General Atomics Buys
Beverley Mine**

General Atomics (GA) has concluded an agreement to acquire the Beverley uranium property from TMOC Resources, a subsidiary of Australia Gas Light Company, pending final approval by Australian government authorities. TMOC, which had owned 50% of the deposit, acquired Western Nuclear's 50% interest earlier this year, giving TMOC 100% ownership.

GA's long-term objective is to develop the property, subject to market conditions and Australian government approval. The Beverley deposit is located north of Adelaide, South Australia; its estimated reserves total approximately 30 million pounds equivalent U_3O_8 , at an average grade of 0.27% U_3O_8 . This acquisition of the Beverley deposit is GA's first step in a strategy of expanding its front-end fuel cycle activities beyond its Sequoyah Fuels Corp. conversion business.

ELECTRICAL ENERGY ALTERNATIVES AND THEIR EFFECT ON THE ENVIRONMENT

This essay by J. Robert Wolcott, chairman of NUEXCO's International Advisory Committee, discusses many of the issues prevalent in today's electrical energy industry. All energy alternatives have pros and cons; so in this environmentally conscious era, what direction should the United States choose?

The United States has alternated its favored electrical energy sources several times over the past fifty years. It may soon change course again. Fifty years ago, the favored source was hydroelectric power. Electricity demand at the time was relatively small in comparison to today. Many rivers provided excellent, economical sites. In the 1950s, rapid growth in demand shifted interest to gas and oil because they were relatively clean, cheap, and easily transportable.

A growing dependency on foreign oil led to the oil embargo and the rapid increase of prices in the 1970s. Use of oil was then discouraged by cost and federal regulation. Natural gas prices rose with oil prices, and federal regulations multiplied.

Coal and uranium emerged as the favored fuels. However, nuclear power then came into disfavor in the late 1970s and throughout the 1980s. Emphasis on coal increased. The need for short construction schedules and reduced

atmospheric emissions has since returned the emphasis to natural gas. Now pollution concerns are calling all fossil fuels into question.

Hydroelectric sites are unavailable. Oil supplies are limited and foreign sourced. Coal is recognized as a major source of pollution. Natural gas is costly and limited. Renewable energy sources are incapable of meeting needs. And nuclear power safety and waste disposal issues still hinder its acceptance. So, where does the United States go from here?

The Swedish Example

How does the Swedish example relate to the United States? First, Sweden is a small country where the energy picture comes more clearly into focus than in the much larger United States. Moreover, Sweden's environmental and political course is much like that of the USA. Sweden's evolution may help us see more clearly what problems lie ahead for the USA. Finally, Sweden's solutions may guide the USA. Half of Sweden's electric power is hydroelectric and half is nuclear. In March 1980, shortly after the Three Mile Island (TMI) accident, the public voted to phase out nuclear power. The completion date was set for the year 2010. Subsequently, Sweden added constraints on non-nuclear energy. A carbon dioxide emission increase was forbidden for environmental reasons. Further development of hydroelectric was prohibited to avoid environmental damage to rivers. Oil and gas were viewed with disfavor because both had to be imported. Solar, windmills, conservation, and other non-

conventional sources were encouraged, but proved mostly impractical. Ample electrical power was available due to surpluses, so these decisions had no immediate impact. However, the surplus could not satisfy growing needs indefinitely. A moment of truth has arrived. Swedish utilities

pointed out that they cannot wait until 2010 to act. A phased shutdown with a parallel building of replacements is required. The utilities proposed the shutdown of two of Sweden's twelve nuclear plants as a start; the first in 1995 and the second in 1996, and an immediate start of construction for replacements.

Now real issues had to be addressed. Should nuclear really be shut down? Should it be replaced? What technology was superior? Who should pay? Can Swedish industry survive, much less remain competitive, without ample electricity?

Electricity is the heart of the American industrial system and far too important to be tinkered with based on theory rather than experience.

ESSAY

The Minister of Energy and Environment argued that Sweden need not worry. Effective conservation would allow a 50-percent reduction in consumption even while GNP grew 50 percent. Labor and industry, among others, did not accept that argument. Sweden's energy intensive industries are expected to grow. Sweden is expected to remain among the top few nations in per capita electrical consumption. Sweden's industrial growth is already lagging that of all of Western Europe. The public is taking another look. Recent opinion polls indicate the public favors hydro first, nuclear second, gas third, oil fourth, and coal fifth. The Minister of Energy has been replaced.

So Sweden is without a national energy policy and is in the grips of an "energy gridlock." A new plan is to be prepared for consideration by Parliament in early 1991. What will that plan entail? I believe it will evolve over time such that it:

- will not allow nuclear shutdowns;
- will ease carbon dioxide emission limits;
- will continue to prohibit large scale hydro development;
- will restate hopes for conservation;
- will express renewed interest in new, safety-intensive nuclear energy concepts.

The United States Parallel

One can, of course, see conditions in Sweden that are similar to those evolving in the USA, where many contradictions become publicized. Some have no scientific or economic foundation and some are realistic. The following list illustrates the diversity of opinions that one reads, hears, and sees via the media.

- Acid rain, ozone depletion, and global warming are leading to an uninhabitable earth.
- Global warming has already begun. By the end of the next century the world's average temperature will have increased 3 to 8 degrees; the sea level will have risen several feet; coasts will have flooded; weather patterns will have changed. A crash corrective program is essential.
- Carbon dioxide emissions must be reduced 20 percent by the year 2000 and much more by the middle of the century.
- Deforestation is decreasing carbon dioxide absorption capacity. More trees must be planted. South American nations must stop clearing forests.
- The "population bomb" is about to explode.

● Third-world countries must industrialize and more use of fossil fuels is necessary. Industrialized countries must reduce energy use to compensate.

● Electric energy growth and economic growth go hand in hand. All nations—developed and undeveloped—need more electricity.

● The electrical automobile is a necessity.

● The present generation is morally obligated to preserve fossil fuels for future generations.

● Imported oil is jeopardizing national security.

● Nuclear power safety is inadequate, waste problems have not been solved, and public opinion will not permit new construction.

● We need not worry. Conservation will allow the US economy to grow even though consumption is reduced to 25 to 40 percent of current levels.

● With more development support, windpower, wood, biomass, solar, and other renewables will be the way of the future.

● A national energy policy is the solution.

● An "environmental democracy" (whatever that is), is the solution.

The list is far from complete, but that sampling does illustrate the challenge of developing a working consensus.

United States Supply and Demand Situation

Now, let's turn to supply and demand considerations where facts, rather than rhetoric, take precedence. Since the oil embargo, total energy use has remained essentially flat. While non-electric energy use has declined six percent (largely because of more efficient automobiles), use of electricity has risen 50 percent. Demand growth for the past several years has been about four percent per year, while new capacity additions have been only about one percent per year. The utility industry has met demand by capitalizing on surpluses available from excesses created earlier from construction starts which had been planned when the anticipated growth rate was 7 percent. Improved load balancing and transmission systems aided further. Conservation reduced demand approximately three percent, almost the equivalent of one year's growth. Supply problems are now becoming more apparent as the national reserve margin is shrinking. While modest surpluses of capacity continue in the Southwest and Northwest, the Northeast and Atlantic regions are on the edge of brownouts.

Most forecasters project demand to increase at a rate of 2 to 3 percent per year for the forthcoming decade. Even at this level, which is lower than the past decade, additional capacity equivalent to approximately 200 new plants will be needed by the year 2000. How will that be accommodated? Because of restraints on coal, oil, and nuclear, the utility industry is resorting to natural-gas-fired turbine plants as an expedient. Gas has high total production costs, but fills a need because such units can be built quickly with minimum controversy. Formerly, gas turbines were constructed almost wholly to meet peak load demands. Emphasizing gas turbine construction will continue only for a time. More suitable sources must be used sooner or later. What will those be?

The Environmental Influence

Environmental forces will have a major, and possibly decisive, impact on energy choices. Economics will remain important, but only influential. The environmental problem is enormously complicated. Every activity in the world contributes to the temperature and world makeup; the sun, the atmosphere, the soils and rocks, the earth's internal forces, the plants, the animals, the oceans, and more. The items causing concern from man-made influences are acid rain, ozone depletion, and global warming.

Acid rain is believed to be caused mostly by sulphur released to the atmosphere, which forms into sulfuric acid, a compound particularly harmful to trees and other vegetation. Power plants which burn fossil fuels, and especially coal, are the greatest contributors of sulphur. Much can be removed at the source and major efforts are being made to do so.

Ozone layer depletion is considered a grave problem because the ability of that layer to absorb the sun's ultraviolet rays is reduced. The principle cause of ozone depletion is believed to be man's use of chloro-fluoro-carbons (CFCs), more commonly known as freon. Chlorine from CFCs tends to break up ozone molecules and also inhibit creation of new ozone. Action has been taken to reduce use of CFCs to a much lower level by the year 2000, though the problem will continue.

The most publicized threat is "global warming", to which the "greenhouse effect" is the main, but not sole, contributor. The earth absorbs solar radiation and reflects some energy back to the atmosphere as infrared radiation, which is absorbed by the water vapor, carbon dioxide, methane, nitrous oxide and ozone. The atmosphere, in turn, radiates some of that infrared energy back to the earth. This cycle of absorption and re-radiation is vital to the maintenance of a livable habitat on this planet. As pollutants raise the density of the atmosphere, the percentage of radiation reflected back to the earth rises. That process is the "greenhouse effect".

The theory of the greenhouse effect is well known, but much of what actually happens is uncertain. How much of an effect has man already made? Can the environment compensate and how fast? What caused freezing and thawing centuries ago? There is not enough empirical data from the past 150 years to produce reliable answers. Projected changes of a few degrees in a hundred years means the rate of change is so small that reliable

measurements of world temperatures will require years of study. Highly sophisticated computer models have not been able to duplicate past history, so they cannot be regarded as reliable indicators of future developments. While

many scientists are convinced global warming has begun and must be dealt with immediately, almost on a crash basis, other scientists remain unconvinced.

On the political side, however, the global warming momentum is escalating. The media has declared itself pro-environment, which means it feels justified in less-than-balanced reporting. Federal funding is growing, and with that, a building of vested scientific interests. Environmental activists find global warming a most effective cause on which to build and encourage fears. The issue is an especially attractive because it involves the entire world.

Whatever the state of knowledge, the political influence on energy choices will be substantial. Political velocity exceeds scientific velocity. But the decisions will be made anyway. As we subsequently discuss energy alternatives, it may be helpful to keep in mind relative emission values, for these will be influential.

*Additional capacity equivalent to
approximately 200 new plants
will be needed by the year 2000.
How will that be accommodated?*

ESSAY

Using coal as a reference, how do CO₂ emissions compare:

Coal	100
Oil	81
Wood	81
Natural gas	56
Uranium	0

A Look at Alternatives

Alternatives must be examined one by one for each has different advantages and disadvantages.

Coal: Coal is abundant, competitive, and dirty. Electricity produced from coal contributes 25 percent of the world's CO₂ emissions, as well as sulphur, nitrous oxides, particulates, carbon monoxide, volatile organic compounds, methane, and other pollutants. Each pound of coal burned produces approximately three pounds of carbon dioxide. A large station may burn as much as a million pounds of coal per hour and emit three million pounds of carbon dioxide. A train load of coal can disappear into the atmosphere within a matter of hours.

Oil: Oil pollutes less than coal, but only by 20 percent. Half the 16 million barrels per day used by the United States must be imported. Long-term availability is uncertain. (A generating plant is expected to require ten years for construction and operate for at least 40 years.)

Natural Gas: Natural gas is the cleanest fossil fuel, but does produce carbon dioxide, sulphur, methane, and other pollutants. Natural gas leakage is a special problem, because the methane that escapes is among the most damaging of pollutants. Expediency will require extensive use of natural gas over the next decade.

Wood: Wood was a "back-to-nature" favorite a few years ago. A popular bumper sticker, many will recall, was "Split wood, not atoms." While splitting proved benign, cutting trees and burning did not. Wood produces large quantities of carbon monoxide, particulates, organic compounds, and smoke.

Biomass: Garbage, wood shavings, cow manure, and the like are often useful for cogeneration, but their potential contribution is minor.

Geothermal: Geothermal does not require fuel, is reasonably economic, and is comparatively favorable from an environmental standpoint. However, availability in most of the United States is very limited. Geothermal supplies less than one percent of national supply, and nearly all of that is in California.

Hydroelectric Power: Hydroelectric power is clean, reliable, and economic. Six percent of the nation's power is from hydroelectric sources. Economically attractive sites are very limited and are environmentally restricted. Some small hydroelectric dams will be built, but hydroelectric sources are no longer a major contributor. Nor will they ever be again.

Solar: I recently saw a national poll in which the public was asked: "Which one energy source do you think will be our primary source of electricity ten

years from now?" The three first places were nuclear—27 percent, solar—17 percent, and coal—9 percent. Why are the expectations for solar so high when its contribution is negligible and no substantial expansion is planned? Ten years is a short time. Construction alone of such facilities usually requires ten years. A significant contribution within ten years is impossible.

Solar's problems are not simply technical. Even when those are solved, as they will be, major economic obstacles remain to hinder the integration of solar into utility systems. The sun does not always shine. The public wants electricity rain or shine, night or day. A couple of examples may illustrate.

A variety of solar energy systems are being developed; one at California's Barstow station focuses sunlight on a boiler to produce steam for a conventional turbine generator. But provisions must be made for periods during which solar does not produce. A gas-fired boiler is provided for that. Think about the system that exists after a natural gas boiler is added. The generating station is equipped with two complete steam generation systems. One, the solar part, can operate part of the time. The other,

The political influence on energy choices will be substantial. Political velocity exceeds scientific velocity. But the decisions will be made anyway.

the natural gas part, can operate virtually full time. Why not simply use the gas boiler full time? Fixed costs go on whether used or not. The savings from solar operation will be part-time fuel cost. The real function of solar becomes that of a part-time fuel saver. Justifying 30 to 50 square miles of land for collectors and solar's high capital costs, merely for fuel savings, will be difficult.

Another alternative may employ energy storage devices, such as batteries to be charged when the sun shines and discharged when circumstances require. To meet normal daytime load, and simultaneously charge batteries, would require a doubling or tripling what solar plant capacity might otherwise be needed. Again, think about that in relationship to a utility system. If battery storage is practical and affordable, why not charge with fossil, nuclear, or other already available means, during off-peak hours? Most generating plants operate at about 60 percent of capacity, but if demand were available, could operate at 90 percent. The 30 percent of unused capacity could be utilized for battery charging. So solar again competes against incremental fuel costs.

Solar is useful for remote electricity needs, heating, and other specialized applications. But the likelihood that solar will play a significant role in central station electrical power during the next several decades is remote.

Windmills: Windmills depend upon weather, require tens of square miles, are noisy, interfere with television, throw icicles, and have other disadvantages. Construction was once motivated by special tax credits, but those credits no longer exist. The system obstacles described for solar also apply to windmills. Although useful in special situations, the disadvantages preclude a major role.

Conservation: Conservation has made, and is continuing to make, an important contribution. Conservation has reduced the nation's peak demand about three percent, roughly equivalent to one year's growth in demand. In other words, conservation has avoided the need for approximately 20 generating plants. How far conservation can be used to advantage is yet to be determined. "Conservation" must be considered in several categories. The various types embrace quite different economic, social, and political principles.

● First, the American ethic voluntarily eliminates waste. We have an ingrained, psychological opposition to waste. We extract every last drop of toothpaste simply because of a mindset opposing waste.

● Second is free market action whereby adjustments in supply and demand take place according to price. As electricity costs have increased, demand has changed. That adjustment does not work in command economies. For example, the USSR used 3.3 times as much energy per unit of output as did Western Europe in 1984.

● Third is allocation of investment. Investments may be employed to reduce demand or to increase supply. For example, rather than investing in facilities to provide heat for a home, that same investment might be used to insulate the home in a way that would reduce heat requirements.

● Fourth, is regulation. Specifications introduced through the legal or regulatory system may reduce energy requirements, whatever the consequence. For example, building codes may specify insulation requirements, and thereby eliminate choices.

● Fifth, is "coercive utopianism" where measures are taken to promote a particular ideology. One way involves creation of shortages; shortages lead to rationing; rationing leads to government control; government control leads, so the elite believe, to administration by the "good"; and administration by the "good" will lead to social changes.

I encountered an example of "coercive utopianism" at a recent conference to discuss whether nuclear power should be revitalized in light of global warming. Sixty or seventy specialists from various technical fields, political persuasions, and ideologies attended. At dinner one evening, a small group of us became involved in a discussion of conservation.

I offered the observation that one was justified in being conservative when planning on the results of conservation until it was clear what would actually be achieved. Excess optimism

could be very costly, while excess conservatism (that is, building too far in advance of need) carried only a small cost.

Why are the expectations for solar so high when its contribution is negligible and no substantial expansion is planned?

ESSAY

I cited what I thought was a rather convincing example, namely, the California highway situation. I recalled that Jerry Brown, when governor, stopped freeway construction on the theory that there "had to be a better solution to California's growing traffic needs than covering the state with concrete and asphalt." But Jerry never saw fit to identify it. Traffic problems grew for eight years. Solutions grew not at all. Now California has a double problem; compensating for lack of past highway construction, while attempting to cope with population growth. Despite special efforts, highway capacity is increasing only one-fifth as rapidly as needed. New taxes, among other measures, are being imposed to do some of what should have been done before. The result did not seem to me to be a desirable one.

However, a "coercive utopian" sitting next to me saw things differently. He reacted with "Ah, but Jerry Brown was right! Had his policy prevailed, people would have been forced to use mass transit, forced to ride bicycles, forced to work at home, and forced to make many other beneficial changes." Perhaps, but do we really want those choices made for us? Who is to say those changes would have been beneficial?

Nuclear Power: I have put nuclear power last on the list because the process of elimination in virtually all studies seems to focus attention sooner or later on more use of nuclear. More than 400 nuclear plants operating in 26 countries provide 17 percent of the world's total electrical generation. The 110 plants in the United States supply 20 percent of the nation's electricity. Although orders have continued in France, Japan, China, and elsewhere, an order has not been placed in the United States for 15 years. Nevertheless, many ordered before the mid-1970s have been constructed, entered service in the 1980s, and have accounted for 35 percent of new capacity the past fifteen years.

Various issues, not the least of which are waste disposal, safety, licensing, regulation, and public resistance, have contributed to the stalemate. The nuclear weapons facilities problems, though not directly related to commercial plants, have added difficulties by association.

Uncertainties have caused investors to be reluctant to invest in nuclear facilities, particularly because licensing and regulation destroys confidence in costs and schedules. Changes forced during the course of project construction have greatly increased costs and added delays. Moreover, nuclear plants especially, have been subjected to after-the-

fact "prudence reviews" that have prevented utilities from recovering ten billion dollars for costs over which they had little or no control. The public is satisfied neither with the plants' safety nor with waste disposal. Chernobyl was a very major setback that will forever affect nuclear power. (Even so, Mr. Gorbachev said in 1989 that "...safety should be guaranteed. But we won't survive without nuclear power.") I'll discuss safety and waste subsequently.

A Summation: Before proceeding further I'd like to sum up where we have come. The power generation means discussed divide into several categories.

- ◆ Fossil fuels include coal, oil, and gas. Those are proven and practical, but are major contributors to atmospheric pollution.
- ◆ Nuclear fuels do not release emissions to the atmosphere, but are stymied by public attitudes.
- ◆ Hydroelectric is environmentally attractive because it does not pollute, but also environmentally unattractive because of its impact on streams and rivers.
- ◆ Renewables such as wind, solar, and geothermal, are limited in capability, and some are unproven. (Less than one percent of the world's electrical power is produced by renewables and most is geothermal.)
- ◆ Conservation has produced benefits. The easy steps may have been taken and the cost of achieving future results may increase. Limits remain to be tested.

Those are the choices. I think it is clear that when one realistically considers the alternatives, as many have done, more use of nuclear power is unavoidable. Only the timing remains uncertain. Future generations simply will not forego that immense energy resource while fossil fuel problems grow and the nation needs the energy.

Nuclear Safety

As promised, I'd like to expand on nuclear safety. Some hold strong views that are probably not resolvable; I include those who believe nuclear power should not be utilized for one or more of the following reasons.

- Plutonium is bad and any systems which produce it should be banned. *I believe that plutonium can be dealt with—in fact, it is already here and being dealt with.*
- All radiation is bad and systems which produce it should not be permitted. *The fact is that radiation is a natural phenomenon that we cannot avoid.*

● A Chernobyl-type accident is probable in the United States and risks outweigh possible benefits. *While an accident is always a possibility, American-type reactors and US regulatory procedures reduce risk to minimal levels.*

● Nuclear power should be opposed simply because it is nuclear power. *This quasi-religious resistance to nuclear power is not a rational point of view that will prevail with time. There is, as I say, no point in dwelling on those issues, because much is based on faith or intuition and probably not resolvable.*

Concerns related to safety and waste can be approached more rationally. Without TMI and Chernobyl—mainly Chernobyl—nuclear power's problems would be far, far less. Those two events were watersheds, although of different magnitudes. TMI was a financial and public relations disaster. It was not a complete technical disaster nor health disaster. The ultimate protection provided in the design proved adequate. Not a single person was injured, nor was property damaged outside the plant itself.

Chernobyl, in contrast, was a complete disaster in every respect. The figure first announced by the Soviet government of 31 people killed is certain to be low. Financial consequences to surrounding territories will be far greater than first admitted. Radiation releases caused extensive external damage. The basic technical concept was chosen to produce weapons material and electrical power; this compromise reduced safety. Containment according to Western standards was not provided. Operational practices were inadequate. Secrecy precluded proper post-accident actions. All would have been unacceptable in the USA.

Nuclear safety must, nonetheless, be improved. The public wants more safety and the industry has accepted the challenge. Passively safe and inherently safe concepts are being developed which depend upon natural laws for control and cooling, and much less upon operators and equipment.

Waste Disposal

Erroneous perceptions about nuclear waste abound. The high-level radioactive waste generated in the reactor core is the most radioactive and long-lived, and therefore most

important. A moment of perspective on this waste may be worthwhile.

A reactor core contains several hundred fuel bundles arranged in a cylinder approximately 10 feet in diameter and 12 feet in length. The volume is approximately 1,000 cubic feet, though only a portion of that is fissionable material. An average of 20 percent is changed each year. (Termed "spent fuel" after removal.) The volume of the twenty percent removed is less than a six foot by six foot cube. Spent fuel can be stored as fuel bundles in the form removed from the reactor, as Sweden and Finland do. Although that may not be the form for final long-term storage, storage in that form is feasible for hundreds of years.

Only a few percent of spent fuel consists of radioactive fission products and plutonium. The remainder is reusable uranium. The few percent that are radioactive products can be chemically separated by reprocessing. After reprocessing, those fission products could be contained in only a few cubic feet of space. The radioactive products may then be embedded in a material such as glassified bricks for permanent storage. The French, British, and Japanese employ processes of this type.

Other means can reduce amounts of radioactive isotopes by converting them to less active, or inactive, isotopes. Certain types of reactors actually "burn" fission products.

A combination of reactors may also be used to reduce the total number of spent fuels with which waste handlers need be concerned. The combination of reactors can operate in tandem, with fuel elements first used by a

reactor of one type and then reused in a reactor of another type. The number of "double duty" spent fuel elements requiring storage or processing is thus reduced.

One reason the national waste program has not proceeded more rapidly is a lack of physical urgency. (Different than public relations urgency.) Thirty years of spent fuel is already being stored at certain power plant sites. One hundred years could probably be stored if really necessary. The federal government has assumed responsibility for final spent fuel disposition and charges utilities one-tenth of a cent per kilowatt hour for the service. The government trust into which the fees are paid has reached six billion dollars. DOE selected a storage site in Nevada, spent five hundred million dollars of that fund, decided what has been done is inadequate, and a new start is being made.

*The record on energy programs
wholly dominated by government
demonstrates that few succeed.*

ESSAY

The "nuclear waste problem" has never been clearly defined. What an acceptable solution would be in the eyes of some is not known. If radioactive wastes must be made completely non-radioactive in a short time, that may be impossible. (Which, of course, is why some nuclear power opponents argue that it is necessary.) If it is enough to provide safe storage, then solutions are already in place. And if the intermediate storage as the Nevada facility will provide is acceptable, that too should constitute a solution. The lack of definition of "acceptable" will continue to plague the industry until resolved.

California

I think it may be worthwhile to look at the situation in California, for California is often a national trend setter. California voters will be asked to vote in November 1990 on a referendum containing many environmental restraints, one of which is that carbon dioxide emissions must be reduced 20 percent by the year 2000. What might be the implications?

California is part of an integrated Western electrical power market that includes Oregon, Washington, and, to a lesser extent, other Western states and British Columbia, Canada. California annually requires approximately 50,000 megawatts of electrical energy. Half is produced from oil and gas, 15 percent from nuclear, 20 percent from hydro, 10 percent from coal, and 4 percent from geothermal. A cutback in carbon dioxide limits may affect the fossil portion, or about 60 percent of the total. If fossil fuel use were reduced 20 percent, 6,000 megawatts (equivalent to six to twelve typical power stations) might be removed from service.

The ultimate impact is not clear. California is a state with a growing demand for electrical energy for uses of all types. Moreover, California will add six million people in the next decade. Air pollution is already a major problem—perhaps greater than any other state—so the need is for more widespread use of electrical energy.

To reduce pollution in areas such as Los Angeles, electric automobiles have appeal. But the electric automobile will require more generating capacity, which may be difficult in the face of a fossil fuel cutback. For example, switching one million autos (about five percent of

California's present number) to electricity would require roughly 3 to 6 additional 1,000 megawatt power stations.

The number is unknown, partly because it would depend upon how users recharge. I recall that Japan's peak power requirements were once largely determined by the tiny electric rice cooker. Each required only a small

amount of energy, but when millions were plugged in at dinner time, peak demand soared.

Search for a National Energy Strategy

In July 1989, President Bush directed the Secretary of Energy to submit to the President, by December 1990, a national energy plan based on the following guidelines.

1. Develop an energy strategy through the year 2030 that can be implemented as soon as possible, rather than waiting until the next energy crisis.
2. Formulate the program so that it will create national consensus.
3. Build on market reliance, rather than coercion.
4. Take a "can do" approach; capitalize on US scientific knowledge and common sense.

My Suggestions

What would I suggest if I were advising Energy Secretary Watkins? The following are a few thoughts.

Assume continued electrical growth: History shows that electrical demand has continued growing despite cost increases, conservation, and other retarding factors.

Fossil fuel use: Anticipate continued fossil fuel use. Support technological advances, but recognize that carbon dioxide cannot be contained and will remain a concern.

Conservation: Press forward with conservation. Make economically feasible changes. Very importantly, learn the limits of conservation.

Global Warming: Go slow until scientific study more accurately determines how large the actual problem is, and the time scale for dealing with it. Emphasize research and development with that objective. In the meantime, however, do what is practical to discourage further increases in carbon dioxide emissions.

Apply taxes in a manner that takes account of after-use costs to society . . . A "carbon dioxide tax" may be one consequence.

Tax Schemes: Apply taxes in a manner that takes account of after-use costs to society, much like that already employed for nuclear fuel. A "carbon dioxide tax" may be one consequence.

Nuclear Option: Proceed with a nuclear power plant prototype construction program designed to bridge the period from the present to a probable much larger need in ten years. Make one objective to have available licensed, standardized, proven, and tested designs by the year 2000. Make a second objective that of completing licensing and regulatory reform. Make a third objective that of restructuring supplier and user organizations for a reorganized industry.

Nuclear Waste: Initiate a bold, comprehensive, coherent, nuclear waste program based on President Bush's "can do" attitude.

Power Plant Siting: Develop plans compatible with *anticipated* rather than *past* siting conditions. Most of the USA's 70 sites accommodate only one or two units. But public attitudes have changed since those selections were made. Fewer sites will gain acceptability and must be used to maximum advantage. Like in France and Japan, power generation capacity will need to be concentrated. Effective utilization of large sites means multiple, standardized units, common auxiliary systems and service facilities, and more extensive fuel handling provisions. New thinking at the conceptual level is needed.

Private Industry: Although government financial and regulatory support is essential, programs must be controlled and implemented by private industry. The record on energy programs wholly dominated by government demonstrates that few succeed.

Imagination: In addition to ground rules outlined in President Bush's directive, add extensive use of imagination. For example, with nuclear, approach reactor design, plant design, siting, waste storage, waste processing, and community acceptance, as a single comprehensive challenge, rather than a series of isolated problems.

Conclusion

The moment of truth for electrical energy policies in the USA may soon arrive, just as it did in Sweden. How will we respond? For how long will we continue emphasizing gas turbines as an expedient solution? Will we adopt what some claim to be a "painless path" and rely on technologies and means not yet proven? Will we accept shortages? A decline in the standard of living? Government imposed rationing? These are among the fundamental questions that must be faced sooner or later.

My belief is that we must continue the "hard path"—that is, relying on what we know will work and *not* what we hope will work—until proven, workable, superior alternatives are available. Electricity is the heart of the American industrial system and far too important to be tinkered with based on theory rather than experience. ■

RAW MATERIALS

THE CROW BUTTE PROJECT NEARS PRODUCTION

The Crow Butte Mining Project received its permit to construct from the Nebraska Department of Environmental Control (NDEC) on April 24, 1990, making it Nebraska's first uranium production project. The permit opened the way for the commercial development of what is likely to be one of the USA's lowest-cost uranium producers.

Initial Discovery

The project was initiated in 1978 when Wyoming Fuel Company, a subsidiary of KN Energy, Inc., noted that Nebraska's geological records showed weak radioactivity in oil and gas wells and a favorable geology for uranium deposits. Other major uranium mining companies had conducted grass-roots uranium exploration in Nebraska previously, but had not found any evidence to encourage exploration. The following year, Wyoming Fuel formed a joint venture with Ferret Exploration Company, Inc. Wyoming Fuel was designated as the project operator. The joint venture acquired a regional lease position on 64,000 acres in the Sioux and Dawes counties of Nebraska.

Reconnaissance exploration led to the discovery of uranium reserves near the town of Crawford in 1979 and 1980. Estimates put the reserves at more than 25 million pounds equivalent U_3O_8 , with an average grade exceeding 0.25 percent. Further exploration in 1981 and 1982 confirmed the initial estimates, and also indicated additional reserves of an equal amount and grade outside what was to become the Crow Butte Project's permit area, but within the Crow Butte Joint Venture properties and the adjacent Big Red properties.

Project Ownership Changes

In 1986, Wyoming Fuel divested itself of its 50-percent share in the project. Ferret Exploration of Nebraska, Inc. (FEN—a 96-percent subsidiary of Ferret Exploration Company) became the owner/operator of the project.

Since 1987, the project has been owned by Ferret Exploration Company/First Holding Company/Geomex Minerals, Inc. (65%), Korea Electric Power Corporation (10%), and Uranerz USA, Inc. (a wholly-owned subsidiary of Uranerzbergbau GmbH of West Germany—25%)

Licensing

FEN submitted a pilot plant permit application to the US Nuclear Regulatory Commission (NRC) in early 1983. The NRC approved a 100 gallon-per-minute (gpm) pilot plant in 1985. The pilot plant's construction was essentially completed in that same year and pilot operations began in mid-1986. Crow Butte purchased the state-of-the-art Trevino in-situ leaching (ISL) plant (**Figure 1**) from Conoco in 1987. FEN moved the entire plant from Texas to the project site, located about four miles southeast of Crawford, Nebraska. Late in 1987, the project submitted applications to the NRC and NDEC for commercial operating licenses.

The NRC issued its license in December 1989; however, the project encountered a delay in Nebraska. The Western Nebraska Resources Council (WNRC) opposed the project and resurrected a century-old Nebraska law which limits foreign ownership of land or leases to less than 50 percent interest. The Nebraska attorney general initially found that the project constituted a majority foreign-owned enterprise. The Crow Butte Project owners then made sufficient organizational changes to satisfy the Nebraska state attorney general. The NDEC issued its license permitting commercial production in April 1990, following the state attorney general's revised ruling in favor of the joint venture.

Project Construction

Using three drill rigs, the project is installing the initial well-field of 120 wells (**Figure 2**), configured in both five-spot and seven-spot arrangements. Pilot plant results suggest uranium recovery rates of 72%-84%, which will be

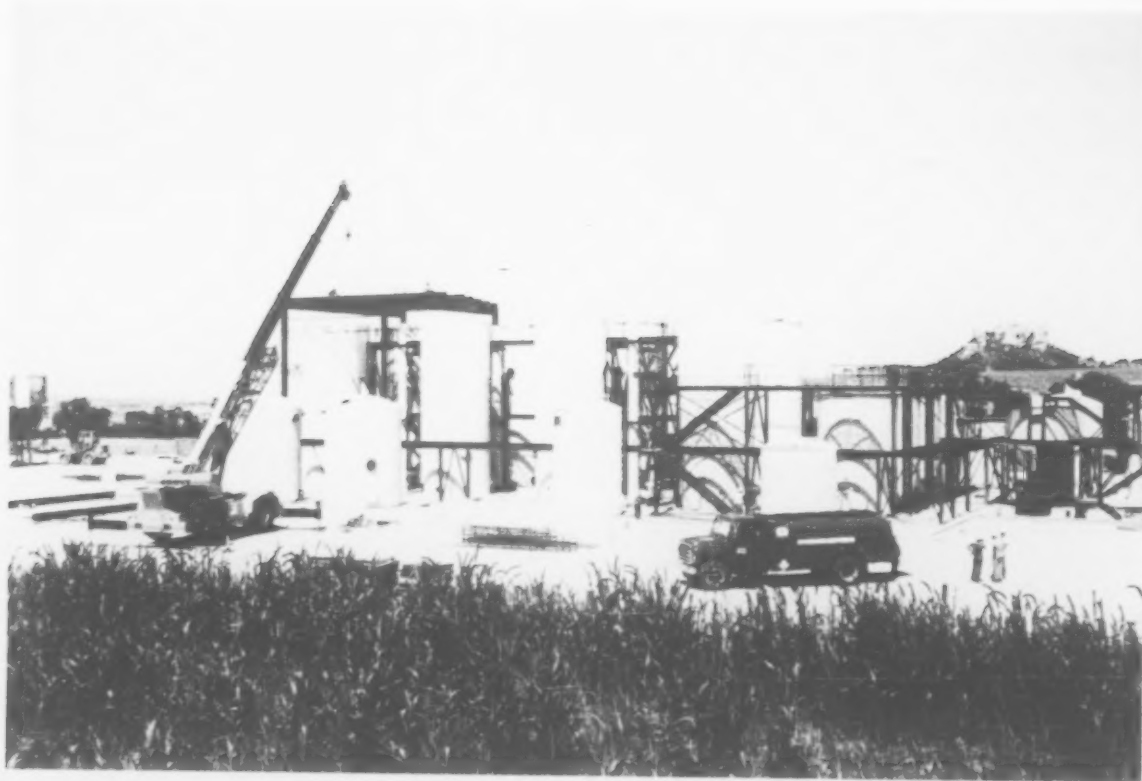


Figure 1 — The Crow Butte Project's uranium processing (ISL) plant, located four miles southeast of Crawford, Nebraska. The 2,500 gallon-per-minute plant was purchased from Conoco in 1987, and moved from its Texas site. Crow Butte, for which the project is named, can be seen in the background, to the right of the plant.

determined by well spacing and duration of leaching. Well flow rates averaging 30-50 gpm (gallons-per-minute) are expected with the average solution grade exceeding 60 ppm (parts-per-million).

The processing plant is currently under construction within the 2,500-acre permit area. Commercial production is scheduled to begin in the first quarter of 1991, at about half of the plant's one-million-pound annual capacity (2,500 gpm). Expansion to a two-million-pound annual capacity (5,000 gpm) can be accomplished with minimal expenditures when market conditions warrant. The plant will employ about 30 people and annually contribute over one million dollars in salaries to the area's economy.

Although the plant is licensed for a yellowcake dryer, near-term plans call for the uranium to be shipped in slurry form. The small amount of low-level waste that the plant will generate will be shipped off-site to a commercial waste facility.

Geology

The Chadron Sandstone hosts the uranium mineralization which precipitated as a roll front along the oxidation-reduction interface of bleached and reduced (chemically) sands. The host formation varies in thickness from 25 feet up to almost 100 feet. The Chadron Sandstone occurs as a continuous unit throughout the trend with minimal claystone and mudstone beds.

RAW MATERIALS

The project has the potential to produce at relatively low cost for several reasons primarily related to the site's geology. Most of the high-grade material is deposited in the base of a highly permeable sandstone formation. Although these deposits, at 400 to 850 feet deep, are slightly deeper than those normally recovered through ISL, the low volume of mudstone and clay-stone coupled with the high artesian water pressures combine to contribute to high flow and recovery rates. Moreover, the uranium is concentrated in one depth range, rather than the more common arrangement of smaller amounts at various levels separated by non-ore bearing layers of material. Finally, the reserves are spread very evenly through a nearly continuous six-mile trend, thereby improving potential wellfield efficiency and flexible production.



Figure 2 — A drill rig is prepared to drill one of the Crow Butte Projects's 120 initial ISL wells.

Production

Additional cost savings will be realized during the initial years of operation because well fields are close to the processing plant. Rather than employ the satellite concept utilized by many other uranium solution mines, the pregnant lixiviant will initially be piped directly to the processing facility. This approach will reduce capital expenditures as well as labor requirements during the first five to six years of commercial operation.

Another difference will be the utilization of solar evaporation ponds rather than a deep disposal well. Two such ponds are being constructed during the initial phase, with three additional ponds planned for expanded operations.

FEN's near-term focus emphasizes cost saving in order to enhance project viability. The acquisition and refurbishment of the Trevino leach tanks and processing equipment will contain initial capital costs to less than \$8.0 million. The Crow Butte reserves should allow an operating life of over 20 years. Under these conditions, the project may have production costs of less than \$10 per pound U₃O₈. ■

CZECHOSLOVAKIA'S NUCLEAR POWER AND FUEL PROGRAMS

Thomas C. Pool, NUEXCO's Supply Analyst, prepared the Uranium Production portion of this article, using photos and other information obtained while in Czechoslovakia earlier this year. During his around-the-world trip, he also toured uranium production facilities in Yugoslavia and the People's Republic of China.

Czechoslovakia has been one of Eastern Europe's most active uranium producers for more than 40 years and has an ambitious nuclear power program that extends into the 21st century. However, changing COMECON relationships, rapid internal political changes, capital constraints, and newly-expressed concerns about nuclear safety have left all plans open to examination and alteration.

Background

Czechoslovakia, with a surface area just under 50,000 square miles, is slightly smaller than the US state of New York. With nearly 16 million people, Czechoslovakia has Eastern Europe's fourth largest population and the second-highest population density. The country's has two distinct ethnic groups: Czechs comprise about two-thirds of the population and Slovaks the remaining one-third.

The Communist Party, which had been in control of the country since World War II, stepped down from power in November 1989. An interim government, with Vaclav Havel as president, promptly took office and scheduled free elections for June 1990. Acting president Havel won a two-year term, as more than 96 percent of the eligible voters participated in Czechoslovakia's first free election in over 40 years.

The new government has the responsibility for creating a national constitution. The Havel government has already progressed toward the creation of a market-driven economy.

- By withdrawing from the COMECON (Council for Mutual Economic Assistance) currency agreements, the government adopted the use of hard currency in all international trade.
- The government reached an accord with the EC, which will gradually eliminate trade barriers between Czechoslovakia and the EC member states.

- As of May 1, 1990, foreign participation in Czech companies is allowed and unrestricted.

The government also renamed Czechoslovakia the *Czech and Slovak Federal Republic*, to give equal prominence to the country's two ethnic groups.

NUCLEAR POWER PROGRAM

Energy Demand

Czechoslovakia estimates that its economy will demand 86 billion kWh in 1990, nearly twice the level of 1970, and that its annual energy demand will reach 117 billion kWh by 2000. Delays and possible closures of nuclear plants could cause supply to fall as much as 16 billion kWh short of the 2000 demand estimate. The country has long relied upon coal to supply its energy requirements. Czechoslovakia has no oil and gas resources, and hydro power can only satisfy a small percentage of annual electricity demand. Coal fueled 87 percent of electrical generation in 1980, and will provide about 56 percent in 1990.

But Czechoslovakia estimates its coal reserves will only last for another 30-60 years at current production rates. Even those production rates cannot be relied upon because a large share of the remaining coal reserves are difficult to access. Additionally, the investment required to obtain those reserves would be unjustified. These rapidly dwindling coal reserves have forced the government to reduce the country's coal dependence and select new sources of energy.

Czechoslovakia does not want to depend on foreign sources of energy, because payment now must be made in hard currency. The country already depends on the Soviet Union for all its oil and natural gas requirements. The use of natural gas as the new fuel source would also necessitate the inclusion of allowances for expensive, major modifications of the gas transport and distribution systems to handle the volumes required.

If oil were chosen as the new fuel source, Czechoslovakia would need to find a new supplier. The Soviet Union has been supplying the 16.6 million metric tons of oil that Czechoslovakia has required annually.

FOCUS

However, the Soviet Union is cutting back all exports of oil, including exports to COMECON countries (totalling 78 million metric tons in 1989), by 7.0 million metric tons this year, because it is concerned about possible fuel shortages at harvest time. The Soviet Union's oil output is suffering both from a shortage of production equipment, and from worker slowdowns (in an attempt to win economic concessions from the government). In July and August of this year, Soviet oil deliveries to Czechoslovakia fell short of the agreed levels by 400,000 metric tons. Czechoslovakia's government sees an expansion of its nuclear program as the only reasonable option, because the country has skilled industrial capabilities and abundant, developed uranium resources.

Energy conservation could help reduce Czechoslovakia's energy demand, but substantial conservation through the application of energy-efficient industrial equipment would prove quite expensive. Czechoslovakia is Eastern Europe's most industrialized country and the world's fourth most energy-intensive. Industry consumes over three-fourths of the country's energy production and utilizes old, inefficient equipment. Almost one-third more electricity is used in Czechoslovakia to produce a ton of steel than in France or West Germany, despite Czechoslovakia's use of old, open-style coal furnaces, rather than newer, electric furnaces. The World Bank ranks Czechoslovakia as one of the two most energy-inefficient countries in Europe. Czechoslovakia's own data shows that western economies require up to 50 percent less energy to produce an equivalent amount of gross national product.

Economics

The availability of capital is Czechoslovakia's major limiting factor in developing its energy programs. Accelerated development in all sectors of the economy, a result of economic and political restructuring, is straining the national budget. Energy production and expansion already consume one-third of the country's industrial funds, which equates to 12-13 percent of the country's annual expenditures. The installation of efficient, modernized equipment will require massive investments of capital and time. Much of the technology to backfit and improve industries may need to come from the West, which will consume a greater share of the limited supplies of hard currency.

Environmental

Environmental concerns have helped reinforce the government's interest in nuclear power. Czechoslovakia has the second highest level of industrial pollution per square mile in the world, and is one of the European countries most affected by acid rain. Many of these pollutants are produced in the mining and use of coal. A recent poll indicated that the environment is the number one public concern. With the public's new freedom of expression, vocal, pro-environment groups have arisen. The Havel government is also quite concerned about the environment. However, the government does not appear to be softening its pro-nuclear position, despite anti-nuclear demonstrations and vocal opposition to the continued operation of the VVER-440 reactors.

Czechoslovakia's government, both past and present, had hoped to reduce pollution by retiring coal-fired power plants as nuclear plants came on line. However, delays in the plans and schedules for the nuclear plants will keep the government from retiring 2,000 MWe of coal-fired capacity by 2000, and another 1,500 MWe by 2010. Over the next ten years, the nuclear plant delays will cause an 11-percent increase in carbon dioxide, a 67-percent increase in sulfur dioxide, an 8-percent increase in nitrous oxide, and a 44-percent increase in fly ash particulates, as compared to the target levels previously set.

Current Nuclear Power Plants

The Czechoslovakian firm of Skoda, Eastern Europe's largest industrial firm and Eastern Europe's only constructor of Soviet-licensed reactor designs, began construction of Czechoslovakia's first nuclear reactor in 1958. Bohunice A-1, a 110-MWe (net) heavy-water-moderated, carbon-dioxide-cooled demonstration reactor, was the result of a joint Soviet/Czech project that began in the early 1950s. Bohunice A-1 (also known as CS-1) began commercial operation in December, 1972. Authorities decided to retire the reactor in 1979 after an employee's error had caused a partial core meltdown two years earlier.

The Bohunice site now has four 408-MWe (net) VVERs (Vodo-Vodyanoi Energetichesky Reaktor; a water-cooled, water-moderated Soviet-designed reactor, similar in concept to a Western PWR). Bohunice-1 and -2 began commercial operation in 1981, and are first generation VVER-440s (the number '440' indicating the reactor's

440-MWe gross rating). The first generation VVER-440 (model V230), the earliest export model offered by the Soviet export agency Atomenergoexport, is based on the Soviet Novovoronezh-3 reactor developed in the late 1970s. Bohunice-3 and -4 commenced operation in 1985, and are second generation (model V213) VVER-440s (incorporating added safety features over the first generation model). Four more second generation VVER-440s started commercial operation at the Dukovany site during the period 1985-1987 (Table 1). Since that time, nuclear power has supplied over one-fourth of Czechoslovakia's electricity needs.

Four 388-MWe (net) second generation VVER-440s are under construction at the Mochovce site and these units are expected to enter commercial operation in the mid-1990s. At the Temelin site, two 892-MWe (net) VVER-1000s are under construction and are also targeted for commercial operation in the mid-1990s. The VVER-1000 is another Atomenergoexport model, and is based on the Soviet Novovoronezh-5 reactor design. Three Czechoslovakian firms supplied the majority of equipment and construction in all the country's VVERs.

- *Skoda Works* produces pressure vessels, steam generators, small pumps, turbine generators, pressurizers, pipes, and fittings;
- *Vitkovice Zelezarny* produces steam generators and pressurizers;
- *Sigma* produces small pumps and fittings.

Czechoslovakia's former government had planned to build at least another 17 nuclear units by the year 2000, allowing nuclear power's share of electricity generation to reach 60 percent by the year 2005. The ambitious plan included two VVER-1000s each for the sites of Kecerovice, Blahutovice, Opatovice, and Temelin (in addition to Temelin's two VVER-1000s already under construction). It also included four more second generation VVER-440s for the Mochovce site. Havel's government is currently reassessing all reactor plans because of capital limitations and safety concerns.

Government Organizations

The new government recently assumed control, from the Soviet Union, of the safety programs for Czechoslovakia's nuclear stations. The Ministry of Energy and Fuels is responsible for the operation of all energy production, including nuclear-powered heat and electricity. This ministry has recently been integrated into the Federal Ministry of Economics, but this article will continue to

Table 1
NUCLEAR POWER UNITS

Reactor	Type	MWe Net	COD ¹
Operating			
Bohunice-1	VVER	408	1981
Bohunice-2	VVER	408	1981
Bohunice-3	VVER	408	1985
Bohunice-4	VVER	408	1985
Dukovany-1	VVER	408	1985
Dukovany-2	VVER	408	1986
Dukovany-3	VVER	408	1987
Dukovany-4	VVER	408	1987
Under Construction			
Mochovce-1	VVER	388	1993
Mochovce-2	VVER	388	1994
Mochovce-3	VVER	388	1995
Mochovce-4	VVER	388	1996
Temelin-1	VVER	892	1994
Temelin-2	VVER	892	1996
Plans Under Review			
Blahutovice-1	VVER	892	—
Blahutovice-2	VVER	892	—
Kecerovice-1	VVER	892	—
Kecerovice-2	VVER	892	—
Mochovce-5	VVER	388	—
Mochovce-6	VVER	388	—
Mochovce-7	VVER	388	—
Mochovce-8	VVER	388	—
Opatovice-1	VVER	892	—
Opatovice-2	VVER	892	—
Temelin-3	VVER	892	—
Temelin-4	VVER	892	—

¹ COD = Actual or Expected Commercial Operation Date

refer to the Ministry of Energy and Fuels when discussing events that took place before the reorganization. The Czechoslovakia Atomic Energy Commission handles regulatory matters, much like the US Nuclear Regulatory Commission; it also conducts research and development, and specialized production, such as radionuclides. Additionally, Czechoslovakia belongs to Interatomenergo, an international organization that has assumed responsibility for VVERs built since 1985 in countries outside the USSR. Interatomenergo, headquartered in Moscow, conducts planning, coordinates production, and

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coordinates and performs design work. The organization, created in a 1979 agreement, also includes Bulgaria, East Germany, Hungary, Poland, and Romania. Just this May, Czechoslovakia joined Italy, Hungary, and Yugoslavia in a group called the Pentagonal Initiative. This group cooperates in economic and cultural matters, and has just added energy to its areas of cooperation. Czechoslovakia suggested the addition of energy, so its representative will chair the energy working group.

Safety Issues

The new government, in its role as the guardian of safety at Czechoslovakia's nuclear sites and stations, has initiated several inspections by international organizations. Two such inspections of the Temelin site reviewed both siting criteria and quality/safety-related aspects. The two inspection teams made recommendations for a number of improvements, but determined that the Temelin site still met recommended IAEA international standards related to their inspections.

Despite the safety inspections, both the Austrian government and Czechoslovakian environmental groups have repeatedly voiced two major concerns about safety. First, the Soviet-designed reactors at Bohunice, Dukovany, and Mochovce lack containment vessels. Second, the reactors at these three sites are VVER-440s, as are the Loviisa units in Finland and the Greifswald units in East Germany, which have had numerous, significant, and widely-publicized problems. For example, design defects have produced accelerated thermal embrittlement of steel and welds in the reactor vessels. In addition, inspectors (which included Czechoslovakian officials) acknowledged that the safety standards of these *first-generation* 440-MWe VVERs "are inadequate with respect to modern safety technology."

However, the Ministry of Energy and Fuels has claimed that its reactors have improved designs, are made of better materials, and are built to higher quality-control standards than the Loviisa and Greifswald units, which were built by the Soviets with Soviet materials. The Ministry has also stated that about 80 percent of the construction and components of the Czechoslovakian VVER-440s are supplied by Czechoslovakian firms. However, conflicting information leaves open the possibility that either Bohunice-1 or -2, or both, have Soviet-constructed, rather than Skoda-constructed, reactor vessels. The Ministry of Energy and Fuels also points out that Bohunice-1 and -2 are its only first generation units, and they were built about

five years later than the troubled Finnish and East German units, thereby allowing the incorporation of numerous, improved safety features.

Some support for these claims comes from the recent inspection of the Paks first generation VVER-440s in Hungary. The Paks units have Skoda-built reactor pressure vessels, which were inspected with the same methods that discovered the thermal embrittlement problems at the Loviisa units. The inspection determined that thermal embrittlement should not be a problem during the Paks station's operational life.

The Ministry of Energy and Fuels has defended the idea that its VVER-440s do not require the immediate shutdowns that East Germany determined its Greifswald units required, following an inspection by West Germany's Gesellschaft fuer Reaktorsicherheit mbH. Still, the Ministry does not contend that its reactors, both VVER-440 and VVER-1000, do not need improvements. In fact, the Ministry of Energy and Fuels has recently been renegotiating its contract, with the Soviet Union's Technobexport, to reschedule fuel supplies for Temelin-1 and -2. The rescheduling is needed because of problems with core-instability, which was discovered in similar VVER-1000 plants operating in the USSR and Bulgaria, and which necessitates compensating revised burnup rates and refueling schedules.

The recent political reforms in Czechoslovakia have offered its government and firms the opportunity to approach a number of Western companies about supplying technology. Specifically, Czechoslovakia's government is interested in obtaining western instrumentation and control (I&C) technology for its nuclear reactors, such as those at the new Temelin station. Havel's government has recently committed to the installation of western I&C technology in all reactors currently in operation or under construction, with the exception of Bohunice-1 and -2 which remain in the forefront of debate. The Atomic Energy Commission estimates the costs to backfit the Bohunice, Dukovany and Temelin sites at over US\$1.0 billion.

Austria's Prime Minister Franz Vranitzky is particularly opposed to the continued operation of the Bohunice site, because of the safety issues and the site's location, which is only 60 miles from Vienna. He has even offered financial assistance in shutting down the Bohunice site, and has offered electricity (at a cost of nearly US\$6.0 million) to offset much of that which Czechoslovakia would lose from shutting down the site for a week of inspections.

Following a July 30 meeting in Vienna, between officials

from the Austrian government, and officials from Czechoslovakia's Atomic Energy Commission and Federal Ministry of Economics, Czechoslovakia's government has decided to supply Austria with safety-relevant documentation on Bohunice-1 and -2, and to offer Austrian officials an examination of the site. Czechoslovakia will also have two IAEA teams inspect the Bohunice site in October. If the IAEA teams recommend closure of Bohunice-1 and -2, Czechoslovakia's government has agreed to comply with that recommendation. Should the IAEA teams not recommend closure of the two reactors, and if the reactors continue in operation beyond a couple more years, both will receive backfits of western I&C technology.

The reactors at Mochovce were to have used a new Czechoslovakian-developed, multi-computer system known as Deris. The Deris system was designed to be controlled by a high-level Soviet system. However, the total system has not met reliability standards and a decision is currently being made as to whether the Deris system will be improved with, or replaced by, western I&C technology. If the Deris system is replaced, it will probably be used to control auxiliary plant systems instead.

Fuel Cycle

All of Czechoslovakia's fabricated nuclear fuel has been purchased from the Soviet Union. Until recently, the Soviet Union had agreed to accept the return of spent fuel without additional charge, because the costs were included in the price Czechoslovakia paid for the fabricated fuel. However, the Soviet Union has now announced that it will institute charges for this return service, and payments must now be made only in hard currency. The charges could be as high as \$1,200 to \$1,300 per kilogram uranium. Because of the additional financial burden these charges impose (possibly \$16 to \$20 million per comparable PWR core reload), Czechoslovakia's government is considering possible sites for its first long-term waste storage site. Consideration is being given to the use of the Bohunice A-1 reactor pool, or, as there are no salt formations, a granite site near the border between the districts of Bohemia and Moravia. Czechoslovakian officials have also held discussions with Cogema regarding the reprocessing of spent fuel.

A recent twist was added to this issue when the new president of the Russian Republic, Boris Yeltsin, proclaimed that he would refuse to allow foreign

(apparently non-Russian) spent fuel and wastes into Russia. Russia contains all the USSR's fuel cycle facilities, including those used for fuel reprocessing and storage. President Yeltsin has not clarified whether his announced ban applies to existing contracts, or only to any future contracts. Though Mikhail Gorbachev, President of the Soviet Union, has repudiated Yeltsin's ban, the additional uncertainty of this possible ban has further hastened Czechoslovakia's waste storage planning.

Future Plans

Czechoslovakia's energy planners are considering Western-designed PWRs for any new nuclear plants that may be built. They are even considering replacing the two VVER-1000s under construction at Temelin with western PWRs of 600 MWe to 1000 MWe (gross) capacity. Such considerations of western I&C technology or full western designs may revive construction of Temelin-3 and -4. At present, Havel's government has put a hold on all planned reactors, in particular Kecerovice, Blahutovice, and Opatovice, for new assessments of safety, both of the sites and of the reactor designs, plus the economics involved in such a large-scale plan. The government remains strongly committed to nuclear power, but the events since November 1989 have introduced an entire reevaluation of timetables, economics, safety, and sources, and the final results of that reevaluation cannot yet be discerned.

URANIUM MINING

Czechoslovakia's uranium industry has been in the forefront of East European uranium production since its inception after World War II. The historic Jachymov mine, which produced radium in the early 1900s, provided much of the country's initial uranium production. However, other deposits were soon discovered and developed.

Through the early 1960s, all of Czechoslovakia's uranium production was directly controlled by the Soviet Union. Much of the labor utilized at that time was provided by prisoners or inmates of forced labor camps. Following that period, uranium was produced under contract to the USSR, but Czechoslovakia had only very limited influence in defining the terms of such contracts. A recent renegotiation and extension of these arrangements will allow the sale of at least some portion of Czech uranium production in the international market place.

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Figure 1
CZECHOSLOVAKIA
NUCLEAR POWER PLANTS AND FUEL CYCLE FACILITIES



The *Československý uraňový průmysl, koncern* (CSUP) directs and administers Czechoslovakia's uranium industry. CSUP is organized into 11 divisions: four mining, four processing, one research and development, one concerning civil works construction, and a general administration division. CSUP employs almost 20,000 people.

Czechoslovakian uranium production will be decreasing in the near- to mid-term as resources at many older mines are exhausted or as the increasing depth of mine workings force costs to higher levels. These operational changes, along with the political changes now sweeping the country, will ultimately result in a restructuring of the Czech uranium industry, along leaner, more competitive lines.

Presently, Czechoslovakian uranium producing activities are focused in four principal areas: Pribram, Rozna, Western Bohemia, and Hamr.

Pribram Uranium District

The Pribram uranium district is located 30 miles south of Prague in a major metal mining area that has been active since the Middle Ages, when lead and silver were the primary products. Today, Pribram is the headquarters of CSUP and is honeycombed with ventilation and hoisting shafts for one of the world's most prolific uranium deposits.

Pribram's mining history has been traced back to 1311, when gold placers were operated under the rule of John of

Luxembourg. Succeeding centuries saw alternating periods of prosperity and decline. In 1779, the world's first deep mine was developed at Příbram. By 1875, this mine had reached a depth of over 3,000 feet and Czechoslovakia had become a world leader in mining technology. In the 1890s, the rapid decline in silver prices and a disastrous underground fire which claimed over 300 lives were crippling blows to Příbram's economy. In 1947, however, discovery of large deposits of radioactive minerals gave the district new life. Mine development was initiated shortly thereafter and uranium production commenced in 1950. More than 10 individual mines were operating during the peak production period, which occurred in the 1960s. One of Příbram's mines is still operating today, which makes it longer-lived than any uranium mine in the west.

Geology

The uranium deposits of the Příbram district occur in a series of steeply-dipping, hydrothermal veins within an elongated area measuring fifteen miles in length and one mile in width. These veins are hosted by weakly metamorphosed Upper Proterozoic sediments, mostly schists, which have been folded, faulted, and intruded by paleozoic granitoids and a wide variety of dikes. Several thousand veins have been identified in the district; over 1,600 have been mined for uranium.

Příbram's uranium-bearing veins are typically extensive (300-3,000 feet) both vertically and laterally, but are generally thin with widths ranging from 0.5 to 40 inches, and exhibit a distinct mineral zoning of calcite, siderite, sulfides, and the uranium minerals—pitchblende and anthraxolite. The vertical extent of the uranium mineralization within the vein system exceeds 6,000 feet.

Mining

During its 40-year history, the Příbram mine complex has compiled an impressive list of statistics:

- The mine workings include over 1,500 miles of horizontal openings and 26 shafts, internal and external, with a total length of over 15 miles (see Figure 3).
- Over 160 million tons of ore and waste have been mined, of which almost 90 million tons have been hoisted to the surface.

Uranium production quantities have not yet been made public, but it seems likely that Příbram has produced in excess of 150 million pounds U_3O_8 . At the peak of its activity during the 1960s, mine production exceeded 10,000 tons of ore and waste per day, surpassing the output of most western uranium mines by a large margin. The mining method at Příbram is principally shrinkage stoping with fill, a relatively labor-intensive method ill-suited to mechanization.



Figure 2 – This headframe in the Příbram district was constructed in the late 1800's, and is illustrative of Czechoslovakia's rich mining heritage.

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The basic sequence of operations includes:

- opening a basal drift along the vein;
- mining upwards following the vein with a minimum opening of four feet in width;
- transferring higher-grade ore through intermediate raises down to the haulage level while leaving lower-grade ore in place to serve as a working platform;
- upon completion of a mining block, withdrawing the lower-grade ore and backfilling the empty block with waste rock.

The mining blocks are served by an extensive rail haulage system. Rail cars containing higher-grade ore are hoisted to the surface six at a time. Lower-grade ore and waste is dumped into underground bins and hoisted separately by skips.

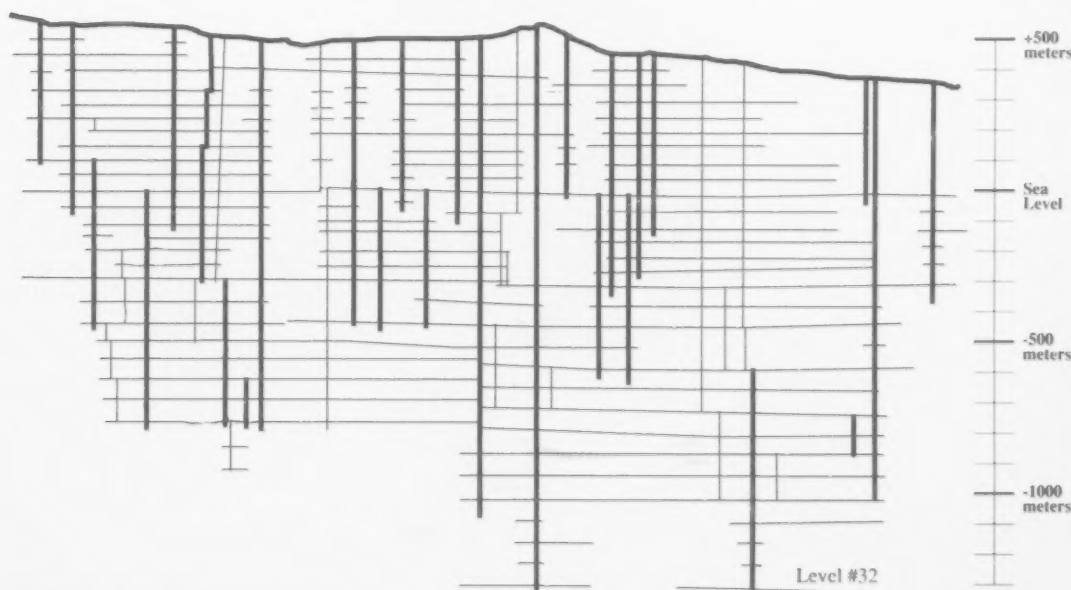
The deepest areas of active mining are now at almost 5,000 feet, a depth at which rock temperatures exceed

100°F and at which rock pressures can cause serious rock bursts. The mine is relatively dry however, and a massive ventilation system provides an adequate working environment. Current production from the Pribram mine is approximately 600,000 tons of ore per year from a work force of some 2,500 employees. Low grade ore is sorted radiometrically at a central sorting plant, which discards much of the waste fraction. The ore fraction and the higher-grade ore from the mine are shipped directly to the Soviet Union by train without further processing.

Rozna Uranium Mine

The Rozna mine is now the only operating uranium mine in the Labe Lineament uranium district, located 80 miles east of Prague. A nearby mine of similar character, the Olsí mine, was closed in 1989. Uranium mineralization within the district was discovered in 1954; the first production occurred in 1958. The original reserves of the

Figure 3
PRIBRAM MINE WORKINGS



Typical vertical section of a portion of the mine workings at Pribram. Vertical lines indicate hoisting and ventilation shafts. Horizontal lines indicate main haulage levels. The lowest level shown is #32, which is located at an elevation of more than 1300 meters (over 4300 feet) below sea level.

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Rozna and Olsi mines totaled 52 million pounds U_3O_8 , but most of that reserve is now exhausted and the Rozna mine has a remaining life of only a few more years.

Geology

The Labe Lineament uranium district is located within a series of folded and faulted metamorphic rocks of Precambrian age which have been eroded to a gently rolling plain. These rocks include paragneisses, amphibolites, quartzites, and metamorphosed limestones. At the Rozna mine, uranium mineralization occurs as disseminations, or in veins and stockworks. Most mineralization is related to shear zones or other structural discontinuities. Disseminated mineralization accounted for the bulk (65 percent) of the original reserves. Pitchblende is the primary ore mineral, but in some areas it is metasomatically replaced by coffinite. In veins, the pitchblende is associated with selenides of copper, iron and lead. Ore grades vary widely from 0.05–0.10 percent U_3O_8 in the metasomatic ores, to 0.15–0.25 percent U_3O_8 in the disseminated ores, to 0.30–0.75 percent U_3O_8 in the vein ores. The main ore zone is one mile long and extends to a depth of 4,000 feet. Individual ore lenses are commonly 7 to 10 feet wide and 60 to 70 feet in vertical extent.

Mining

The Rozna mine has been developed on 24 levels with two main hoisting shafts, three auxiliary shafts, and two internal shafts. Ore production amounts to 600,000 tons per year. The primary mining method, employed to control the very weak ground, is an underhand stoping method termed "top-slicing." The top-slicing method, as implied by name, is based on the removal of successive horizontal slices from the top of the ore. After a slice of ore is removed, the remaining waste rock and debris overlying the mined zone is allowed to collapse onto the floor of the zone. In order to insure the integrity of the roof for the next slice, this floor is overlain with a mat of wire and timber before the collapse is initiated.

Each stoping area is operated by a three-man crew utilizing jackleg drills and two-drum slushers. Round, native timber provides most of the ground support. Ore is hauled to the shafts by means of diesel locomotives pulling 2.6-ton ore cars which are dumped into loading pockets. A 17-foot-diameter Koepe hoist is used to bring 16.5-ton ore skips to the surface at a maximum speed of 2,400 feet per minute. The mine is well-ventilated with an airflow of almost one million cubic feet of fresh air per minute.

Ore from the Rozna mine is processed on site at the Diamo mill to produce yellowcake. Overall employment at the Rozna/Diamo production center totals 3,000 including 700 miners, 500 underground support personnel, 150 mill operators, and a supervisory staff of 100. Electrical consumption for the mine, mill, and townsite amounts to 150 kilowatt hours per ton of ore mined.

Western Bohemia Uranium District

The Western Bohemia uranium district is located in western Czechoslovakia, near the border of West Germany. Radioactive minerals were first discovered in the district during the 1920s when sources of radium were being sought. No development ensued, however, and the district languished until the late 1940s when interest in uranium brought renewed exploration. The first mine in the district, Zadni Chodov, was developed in the early 1950s. Vitkov II followed, and the third mine, Dylen, was developed in 1963. A number of other prospects and occurrences have been identified. The original uranium reserves of the district exceeded 30 million pounds equivalent U_3O_8 .

Geology

Uranium deposits of the Western Bohemia district, extending 15 miles north/south along the border with West Germany, are associated with a system of north/south trending fault zones. The deposits are localized at or near the contact between Proterozoic (Moldanubian) metasediments and Paleozoic granitoids. Two types of ores are characteristic of the district:

- disseminated ores in episyenites;
- narrow veins in strongly-altered wall rocks.

Coffinite and brannerite are the principal uranium minerals; pitchblende is a minor constituent. At the Vitkov II deposit, uranophane and uranium phosphates are developed to depths exceeding 2,000 feet. Ore grades are generally in the range of 0.12 to 0.35 percent equivalent U_3O_8 . The vertical extent of the ore lenses generally far exceeds the lateral extent, and mineralization has been identified to depths exceeding 4,000 feet.

Mining

The underground mines of Western Bohemia are developed by vertical shafts and a series of horizontal levels to depths ranging from 2,000 to 2,500 feet. Levels are now spaced at about 200-foot intervals and are sized to allow dual-track rail haulage for much of their extent. In the lower levels of the mine where rock temperatures reach

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97°F, refrigerated air is used to provide reasonable working conditions in development headings.

The mining method is overhand cut and fill, with two miners working each stope. At the present time, seven stopes, three development headings, and two raises are under way at Zadni Chodov, with 40 miners on each of two shifts. Total employment at the mine is 320. The Vitkov II mine is of similar size, but Dylen is somewhat smaller. Total output for the district is estimated to be about 150,000 tons of ore per year, and perhaps, 500,000 pounds equivalent U_3O_8 per year. Ore from this district is shipped by rail to the Midlovary mill in southern Czechoslovakia.

Hamr Uranium District

Hamr is Czechoslovakia's newest and currently most productive uranium district; it is also the key to the future of the Czechoslovakian uranium industry. The district, located 45 miles north of Prague, was discovered in 1963 and has seen the development of two underground mines and one in-situ leaching (ISL) project. The smaller underground mine, Osecna, will be closed in the near-term, but the larger mine, Hamr, will continue in production.

Geology

The Hamr uranium district covers an area of almost 100 square miles and includes at least eight uranium deposits of varying size. These deposits occur in an uplifted block of Cretaceous sandstones which is underlain by Proterozoic metasediments and granites. Mineralization occurs in Cretaceous sandstones, mostly in the basal units and predominantly in scour channels, in fault-bounded depressions, and at contacts with Tertiary volcanic dikes. Overlying the ore sandstones is a relatively impermeable layer of clayey sandstone. Ore depths range from 500 to 1,600 feet.

Ore grade mineralization is typically rather thick, ranging from about 15 to 40 feet cumulative thickness in several zones to as much as 100 feet in eleven different horizons. Ore grades range from a 0.04 percent equivalent U_3O_8 cutoff for ISL production to as much as 1.0 percent U_3O_8 in isolated pods of redistributed ore. The average ISL grade is about 0.12 percent U_3O_8 , while the grade at the Hamr underground mine is about 0.18 percent U_3O_8 .

The ore minerals include sooty pitchblende, coffinite, ningyote (a uranium, calcium, rare earth phosphate), and a uraniferous metacolloidal zircon. The latter mineral represents a substantial fraction of the uranium content, and is particularly refractory; a circumstance which has contributed to low uranium recovery.

Total resources of the Hamr district have been estimated to be as high as 520 million pounds U_3O_8 , but this would include a significant quantity of lower-grade (less than 0.10 percent U_3O_8) mineralization which may not be economically recoverable. Nevertheless, this total resource marks Hamr as a major uranium district which can make a measurable contribution to world production.

Mining

The Hamr underground mine and the Straz ISL project are immediately adjacent, a situation which causes some hydrologic difficulties, because an underground mine can be operated more efficiently (particularly in sandstone) if it is dry, and ISL production requires a saturated ore zone. The current solution to this dilemma has been the construction of a hydrologic barrier between the two tracts. This barrier consists of 150 water injection wells in a 4.3-mile-long dividing zone. The injection rate is 4,200 gallons per minute. This injection provides a saturated ore zone for the ISL project, but adds to the already burdensome 9,500 gallons-per-minute pumping requirements for the underground mine. Drainage sublevels have been constructed in the basement rocks underlying the mine, but muddy conditions in the ore horizon still create a major operating problem.

The Hamr underground mine has been developed from vertical shafts on two levels: an upper mining level in the ore horizon and a lower (150 feet) haulage level. The mining method is panel and fill, wherein rooms (panels) 16 feet in width and height are driven at a 16-foot spacing for the full length of the ore zone (which is normally 200 to 400 feet). Upon completion, these panels are backfilled with a sand/cement mixture by specially-designed conveyor trucks. After the sand/cement mixture hardens, the intervening pillar can be removed and backfilled in a similar manner. Rubber-tired diesel equipment is used in the ore horizon, while diesel rail equipment is used on the sublevel. Ground support in the panel access drifts is principally steel sets with corrugated steel sheet lagging. Within the panels, splitset rock bolts and wire mesh provide protection for the miners. The ventilation rate is 780,000 cubic feet per minute. The mine production rate is 2,200 tons of ore per day with about 1,200 employees, 600 of whom work underground.

The Straz ISL project has been in operation for 17 years and has been the scene of a great deal of research and development as various wellfield geometries and chemical/hydrological/recovery schemes have been tested. Currently, the project is operated with a sulphuric acid

lixivient, primarily a line drive geometry for injection and recovery wells, and ion exchange recovery. Under the line drive geometry, recovery wells are located on 330 foot centers and injection wells are located on 36-foot centers. The injection and recovery lines (up to 5/8 mile in length) are spaced at intervals of 250 feet. A major consideration in the use of this geometry is its amenability to concurrent agricultural use. Acid strength in the injection solution varies from 20 to 100 grams per liter, and the recovery grade is maintained in the range of 20 to 50 ppm by reducing, through time, the injection rate from 42,000 gallons per day per acre to as low as 2,100 gallons per day per acre. The wellfield is designed for a life of approximately 20 years.

The first wellfield at Straz is now ready to be reclaimed, having recovered in excess of 50 percent of the original reserve. This relatively low recovery is attributed to much of the uranium being tied up in siltstones of low permeability, and to the presence of the zirconium minerals.

Overall, NUEXCO estimates that the Straz project handles a fluid flow of about 10,000 gallons per minute, to produce about 1.5 million pounds equivalent U_3O_8 per year. This rate qualifies Straz as more productive than any ISL project in the USA.

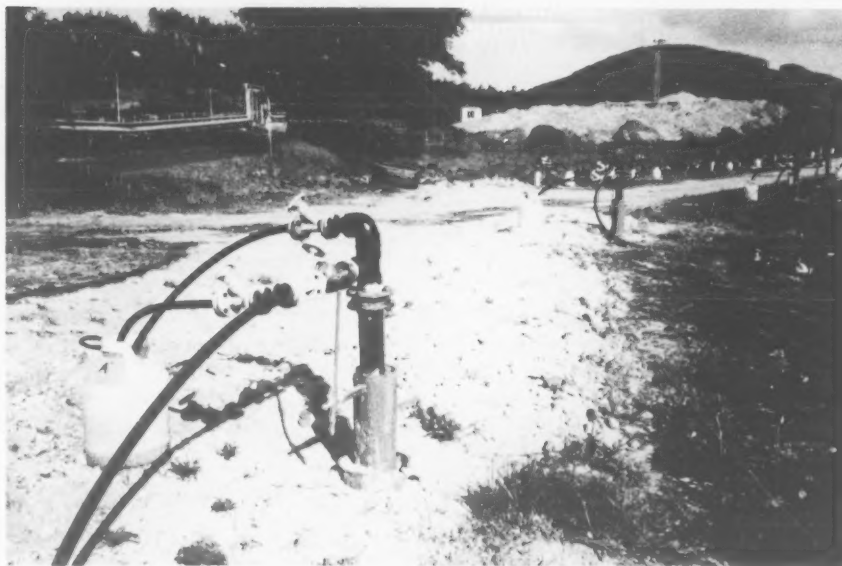


Figure 4 – In-Situ Leaching well field at the Straz ISL Project.

CONCLUSION

As many of Czechoslovakia's older uranium mines are exhausted, and in view of the political changes now sweeping the country, the country's uranium industry is likely to be restructured along more competitive lines. The nuclear program is under great public scrutiny. Safety requirements must be determined and the technology or equipment to provide that safety must be funded.

Despite the obstacles, Czechoslovakia is steadily proceeding with its nuclear program and remains firmly committed to nuclear energy to provide the electrical generation it will require in the 21st century. ■

CALENDAR

NUCLEAR INDUSTRY CALENDAR

1990

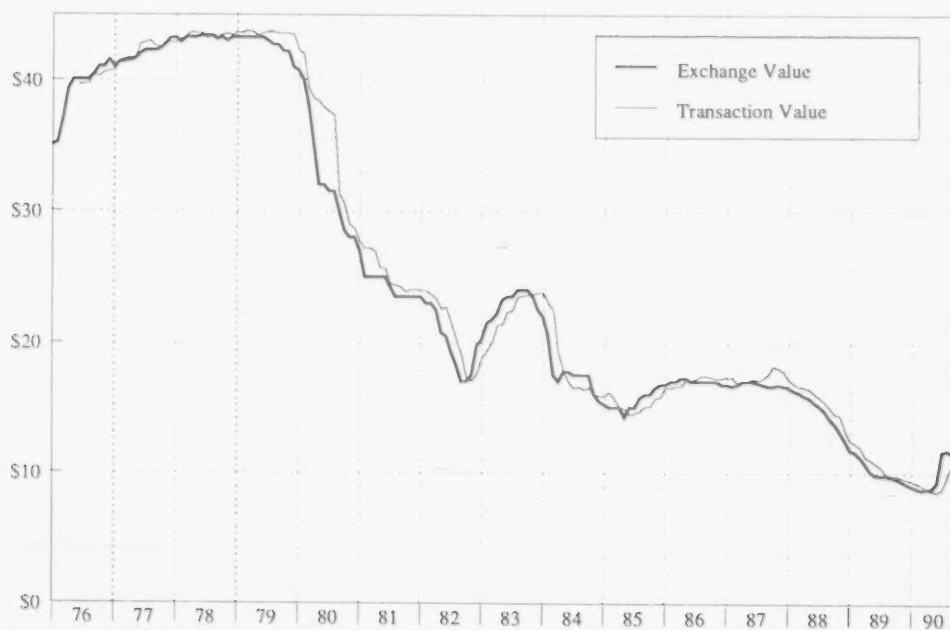
- Sept. 13** *The New Currency: How to Capitalize on Air Emissions Credits* (Watergate Hotel, Washington, DC). Sponsored by The Energy Daily. Contact: Lissa Wilson at 202-662-9728.
- Sept. 13-14** *The Ninth Annual Nuclear Conference: "STANDARDIZATION: Can it Save the Nuclear Industry?"* (Stouffer Concourse Hotel, Washington, DC). Sponsored by McGraw-Hill Nuclear Publications. Contact: McGraw-Hill at 1-800-223-6180 (in NY state: 212-512-6410)
- Sept. 16-19** *Uranium Seminar '90* (Hyatt Regency, San Antonio, Texas). Sponsored by the USCEA. Contact: USCEA Conference Office at 202-293-0770.
- Sept. 23-26** *AMC Mining Convention* (New Orleans, Louisiana). Contact: American Mining Congress at Suite 300, 1920 N Street N.W., Washington, DC 20036, or by facsimile at 202-861-7535.
- Sept. 23-28** *ENC '90 Congress & Exhibition* (Lyon, France). Organized by the European Nuclear Society in collaboration with the ANS and Foratom. Contact: Dr. P. Feuz, European Nuclear Society at 31-21 61 11.
- Oct. 14-16** *World Nuclear Fuel Market Annual Meeting* (Toulouse, France). Contact: Donna Cason at 404-447-1144.
- Nov. 11-14** *Nuclear Energy Forum* (Washington Hilton, Washington, DC). Sponsored by the USCEA and ANS. Contact: USCEA Conference Office at 202-293-0770, or ANS Meetings Department at 312-352-6611.
- Nov. 12-16** *First Regional Seminar for Europe and the Middle East on Quality Management for Nuclear Power Projects* (Prague, Czechoslovakia). Sponsored by the IAEA. Contact: Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.

1991

- April 14-18** *Third International Conference on Nuclear Fuel Reprocessing & Waste Management* (Sendai, Japan). Sponsored by the Atomic Energy Society of Japan and the Japan Atomic Industrial Forum, co-sponsored by the American Nuclear Society and the European Nuclear Society. Contact: Japan Atomic Industrial Forum at 3-508-2411, or by facsimile at 3-508-2094.
- May 13-15** *Second International Conference on Transportation for the Nuclear Industry* (Bournemouth, England). Contact: Conference Secretary, The Institution of Nuclear Engineers at 081-698 1500.

HISTORICAL MARKET DATA

**NUEXCO Historical
Exchange Value and
Transaction Value**
(In US Dollars per Pound Equivalent U308)





HISTORICAL MARKET DATA

HISTORICAL MARKET VALUES

EXCHANGE VALUES												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85	8.70	8.80	8.80	9.25	11.60	11.70	11.45				

US PREMIUM (Relative to the Exchange Value)												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	Discontinued	

HISTORICAL MARKET DATA
UF6 VALUES

Determined as of the last day of the month indicated (\$US/kg U as UF₆)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90	25.25	24.40	24.40	25.50	32.00	32.50	32.25				

US UF6 PREMIUM (Relative to the UF6 Value)

Determined as of the last day of the month indicated (\$US/kg U as UF₆)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	Discontinued	

TRANSACTION VALUES

Determined as of the last day of the month indicated (\$US/lb U₃O₈)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25	9.05	8.75	8.65	8.55	8.80	9.75	10.80				



HISTORICAL MARKET DATA

LOAN RATES

Determined as of the last day of the month indicated (Percent per Annum)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50				

* Float with Prime Rate

CONVERSION VALUES

Determined as of the last day of the month indicated (\$US/lb U as UF₆)

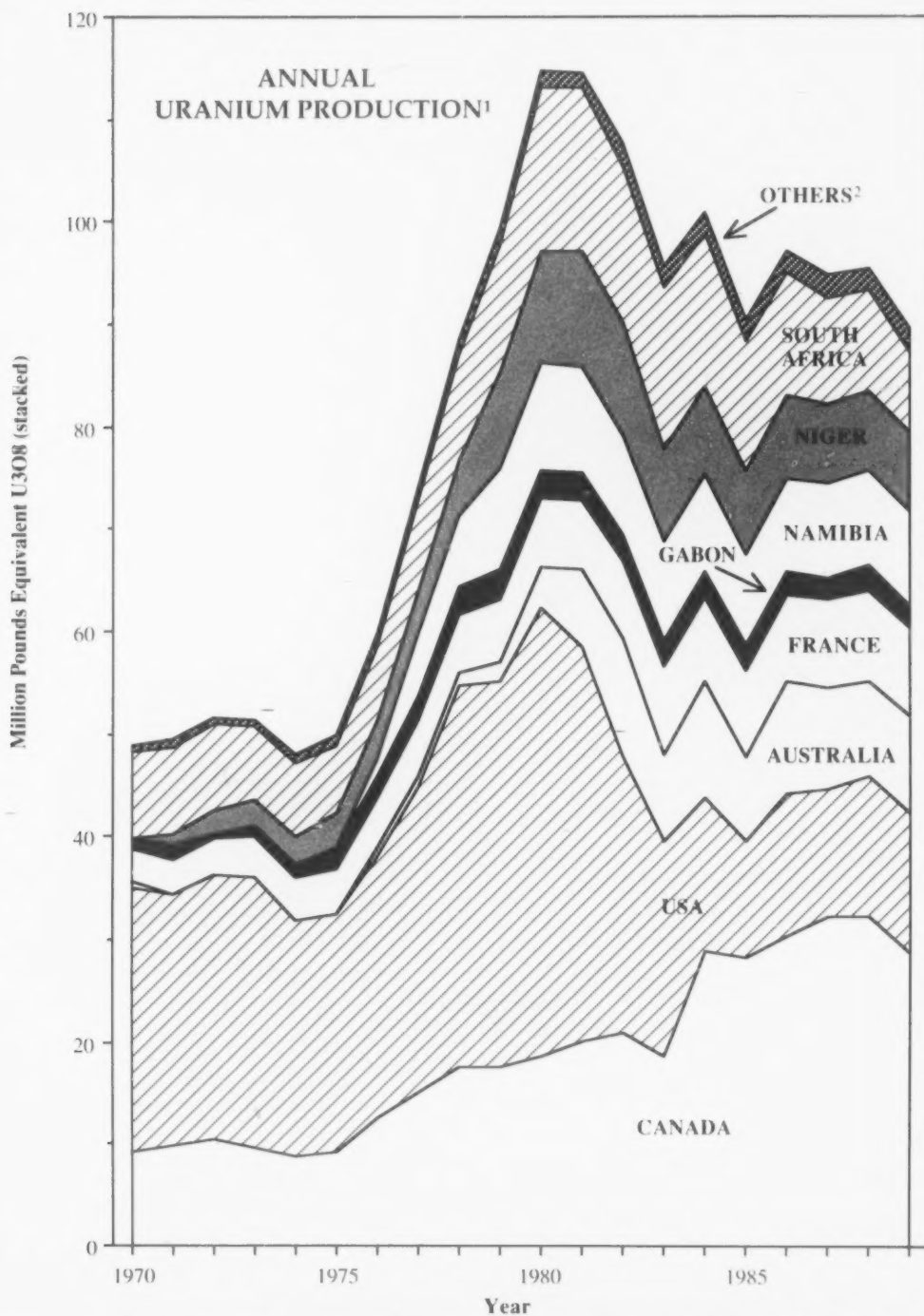
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.50	1.50	1.45	1.45	1.45	1.45	1.45	1.45				

SWU VALUES

Determined as of the last day of the month indicated (\$US per SWU)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54	50	50	50	50	50	50	50				

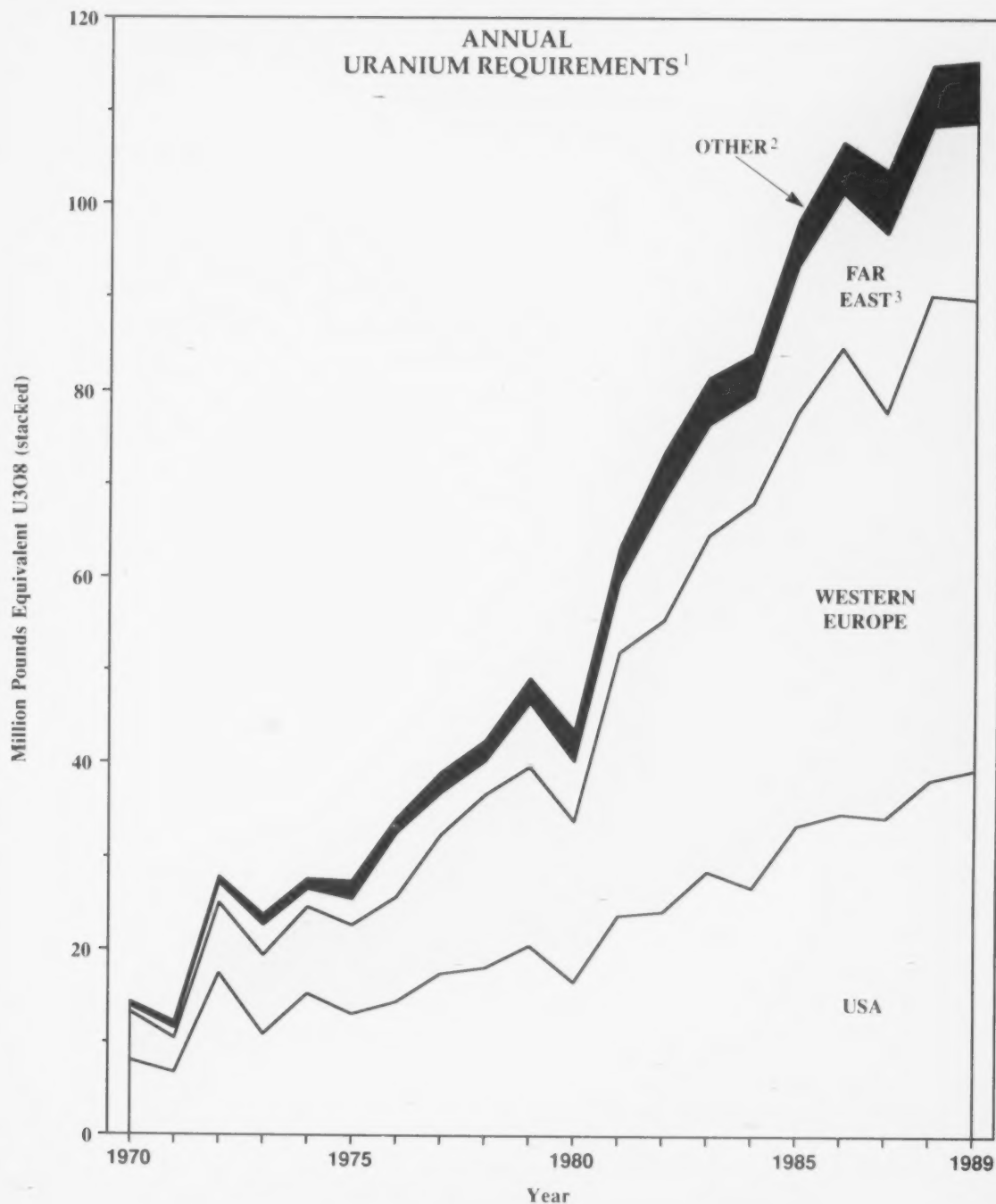
HISTORICAL MARKET DATA



¹ Estimated world production in 1989 totalled 89.6 million pounds (Australia—9.5; Canada—28.7; France—8.5; Gabon—2.2; Namibia—9.2; Niger—7.7; South Africa—7.7; USA—13.7; Others²—2.3).

² Others includes: Argentina, Belgium, Brazil, India, Pakistan, Portugal, Spain, West Germany and Yugoslavia

HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

² Other include: Argentina, Brazil, Canada, India, Mexico, Pakistan and South Africa.

³ Does not include Peoples Republic of China.

GOVERNMENT STATISTICS

AUSTRALIA					
Year	Period ¹	Consumer Price Index ² (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ³ (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia ⁴ (Australian dollars)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates ⁵ (June 1985=100) —
1980	Avg.	95.8	83.1	—	140.8 ⁶
1981	Avg.	105.0	85.9	—	154.1 ⁶
1982	Avg.	116.7	89.0	—	174.9 ⁶
1983	Avg.	128.5	96.9	—	181.9 ⁶
1984	Avg.	133.6	98.0	—	194.4 ⁶
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
1989	Avg.	194.6	117.0	534.65	126.0
Jan	1990	—	119.2	—	128.0
Feb	1990	—	120.8	—	128.0
Mar	1990	204.1	121.5	—	128.2
Apr	1990	—	119.9	—	128.5
May	1990	—	118.9	—	128.7
June	1990	—	116.6	—	—

P = Preliminary **R** = Revised since last month

¹ Monthly data for the period 1967 to 1986 appears in Report 233 (January 1988).
² Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 =100.0). Figures shown at end of quarter represent quarterly average.
³ Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).
⁴ Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.
⁵ Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).
⁶ Base: June 1976 = 100.

GOVERNMENT STATISTICS

CANADA								
Wage-earner Data: Average Hourly Earnings (C\$) ¹								
		Industrial Products Price Index: All Commodities ¹ (1981 = 100)	Consumer Price Index: All Items (1986 = 100) ²	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	90.7	67.1	—	—	—	—	—
1981	Avg.	100.0	75.5	—	—	—	—	—
1982	Avg.	106.7	83.7	—	—	—	—	—
1983	Avg.	110.4	88.5	17.22	—	14.18	10.67	11.10
1984	Avg.	115.4	92.3	17.89	—	14.97	11.11	11.68
1985	Avg.	118.6	96.0	18.53	16.48	15.56	11.85	12.12
1986	Avg.	119.6	100.0	19.38	16.70	15.76	12.28	12.58
1987	Avg.	122.7	104.4	20.12	17.15	16.11	12.58	13.20
1988	Avg.	128.1	108.6	20.91	18.51	16.95	13.17	13.77
1989	Avg.	131.1	114.0	21.97	20.02	18.41	13.71	14.16
Jan	1990	130.8	116.9	21.88	20.39	19.03	13.99	14.78
Feb	1990	131.6	117.6	22.51	20.63	19.14	14.49	15.03
Mar	1990	131.5	118.0	22.52	20.75	19.17	14.99	15.07
Apr	1990	131.3	118.1	23.17	21.20	19.46	14.83	14.93
May	1990	131.8	118.7	23.28	20.55R	19.01R	14.71R	15.06R
June	1990	131.7	119.2	22.31P	21.12P	19.17P	14.70P	15.07P
July	1990	—	119.8	—	—	—	—	—
P = Preliminary R = Revised since last month								
¹ Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.								
² New Base Year of 1986, as of Report 264. Previous Base Year was 1981. All figures in column recalculated by 0.755 multiplier.								
³ Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.								

GOVERNMENT STATISTICS
SOUTH AFRICA

		Average Declared Working Costs per Metric Ton of Gold Ore Milled ¹ (Rand)	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled ² (March 1982 = 100)	Consumer Price Index ³ (1985 = 100)	Production Price Index All Groups ⁴ (1985 = 100)	Total Employment in Mining and Quarrying ⁵	Total Salaries and Wages in Mining and Quarrying ⁵ (1,000 Rand)
							Annual Total ⁶
1980	Avg.	35.53	—	51.9	55.2	709,042	2,237,689
1981	Avg.	41.89	—	59.8	62.7	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	71.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	79.0	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	85.6	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	100.0	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	119.5	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	136.2	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	154.1	705,355	7,774,054
1989	Avg.	116.65	273.0	178.2	177.5	700,360	8,833,934
							Monthly Total
Jan	1990	—	—	192.0	188.8	688,837	801,616
Feb	1990	—	—	193.3	190.3	674,026	767,274
Mar	1990	126.74	296.3	196.4	190.9	684,251	762,303
Apr	1990	—	—	198.3	194.1	696,107	810,474
May	1990	—	—	200.4	196.3	—	—
June	1990	128.25	299.87	201.8	197.0	—	—
July	1990	—	—	203.2	—	—	—

P = Preliminary R = Revised since last month

¹Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

²Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

³Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 236.

⁴Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

⁵Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

⁶Annual total is shown, rather than monthly average for indicated year.

GOVERNMENT STATISTICS

UNITED STATES									
Producer Price Index ¹					Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴				
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	Consumer Price Index ² (1982-1984 = 100)	GNP Implicit Price Deflator ³ (1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.09	13.22	12.67	10.13
1989	Avg.	111.6	112.2	124.0	126.6	13.67	13.75	13.06	10.38
Jan	1990	114.1	114.9	127.4	—	13.75	13.95	13.31	10.50
Feb	1990	113.6	114.4	128.0	—	13.75	13.98	13.24	10.54
Mar	1990	113.2	114.2	128.7	129.7	13.85	14.04	13.30	10.58
Apr	1990	113.1	114.0	128.9	—	13.91	14.32	13.49	10.58
May	1990	113.3	114.5	129.2	—	13.95R	14.10R	13.43R	10.64R
June	1990	113.1	114.2	129.9	130.9	13.91P	14.25P	13.47R	10.71R
July	1990	113.2	114.3	130.4	—	—	—	13.56P	10.78P

P = Preliminary R = Revised since last month

¹US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

²US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

³US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

⁴US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

GOVERNMENT STATISTICS

**VOLUME AND PRICE OF URANIUM DELIVERIES
TO THE EUROPEAN COMMUNITY¹**
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC ² (MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ³ Average Price		Spot Contracts ³ Average Price	
			in ECU per pound U ₃ O ₈	in US Dollars per pound U ₃ O ₈	in ECU per pound U ₃ O ₈	in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,500	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65	\$16.13
1989	13,500	11.5	ECU 26.63	\$29.35	ECU 11.04	\$12.19

R = Revised

¹ The twelve European Community member nations are Belgium, Denmark, France, West Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

² The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³ For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar. Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

GOVERNMENT STATISTICS

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	\$16.10	3.6	n/a	1.2
1977	29.9	27.8	\$19.75	5.6	n/a	4.0
1978	37.0	31.6	\$21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agents

³ Includes imports by domestic utilities and domestic suppliers

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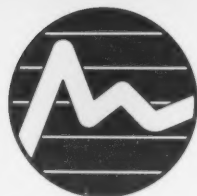
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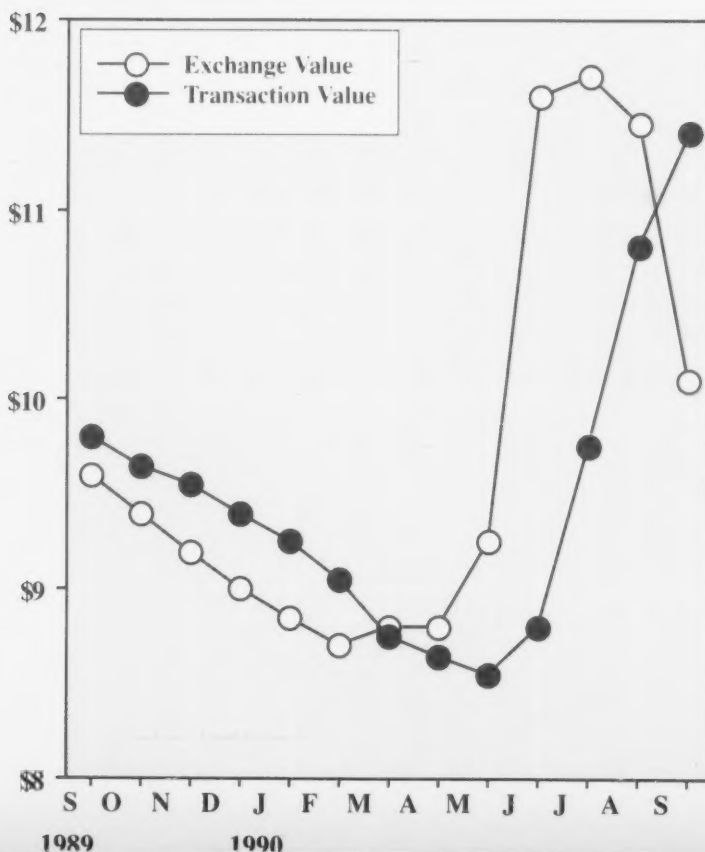
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NUEXCO

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International Directory of
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 **NUEXCO**

MARKET REVIEW

Market Values Summary

NUEXCO Market Values	This Report September 30, 1990	Last Report August 31, 1990	12 Months Ago September 30, 1989
EXCHANGE VALUE¹	\$10.10/lb equivalent U₃O₈	\$11.45	\$9.60
UF₆ VALUE²	\$29.50/kg U as UF₆	\$32.25	\$29.75
LOAN RATE³	3.5% / annum	3.5%	3.5%
CONVERSION VALUE⁴	\$1.45/lb U as UF₆	\$1.45	\$1.90
SWU VALUE⁵ (0.3 % tails assay)	\$50/SWU	\$50	\$63
TRANSACTION VALUE⁶	\$11.40/lb equivalent U₃O₈	\$10.80	\$9.80
Transactions	15	27	19
Months	3	3	4
Millions of Pounds	3.7	5.5	2.7

DEFINITIONS

¹ The **Exchange Value** is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

² The **UF₆ Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

³ The **Loan Rate** is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

⁴ The **Conversion Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

⁵ The **SWU Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

⁶ The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:

- a) Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;
- b) At least ten transactions;
- c) Transactions involving a sum total of at least 2 million pounds equivalent U₃O₈.

DERIVATIONS AND COMMENTS

• All **Market Values** are expressed in terms of US\$.

• All **Market Values** are based on:

- Data from recently completed transactions.
- Data from pending transactions.
- Firm bids to buy or borrow, and firm offers to sell or lend.
- Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend.

• Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these **Market Values**.

• In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers.

• The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.

• For the **SWU Value**, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U²³⁵ and a product assay of 3.0 weight-percent U²³⁵, assuming feed costs corresponding to the NUEXCO **Exchange Value** and **Conversion Value** determined as of the same date.

• In calculating the **Transaction Value**, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future **Exchange Values** or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined.

• The sample time for the **Transaction Value** is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

MARKET REVIEW

SEPTEMBER MARKET REVIEW

(as of September 30, 1990)

OVERVIEW

Supplies were abundant in September, demand for near-term purchases was limited, and sellers competed aggressively. As a result, both the Exchange Value and UF₆ Value declined sharply, showing the largest percentage drops in more than five years. The Exchange Value decreased from \$11.45 to \$10.10 per pound U₃O₈, while the UF₆ Value dropped from \$32.25 to \$29.50 per kgU as UF₆.

Six uranium sales totalling over 4.5 million pounds equivalent U₃O₈ are reported. Two long-term concentrates sales totalled 3.8 million pounds. Two near-term sales included 500 thousand pounds as concentrates, and two sales involved enriched uranium product (EUP) containing about 300 thousand pounds equivalent U₃O₈. No natural UF₆ sales are reported.

No loans or conversion sales are reported. The Conversion Value and Loan Rate remained at \$1.45 per pound U as UF₆ and 3.5 percent, respectively. The SWU Value also remains unchanged, at \$50 per SWU. Three enrichment sales totalled 70 thousand SWU, almost all as EUP.

NATURAL URANIUM AND CONVERSION

The September 30 Exchange Value fell nearly 12 percent, to \$10.10 per pound U₃O₈. This \$1.35 decline is the largest drop in the Exchange Value since October 31, 1984. It is also the second largest percentage drop in the history of the Exchange Value, exceeded only by the 15% drop on February 29, 1984. Increased buyer and seller awareness

of the oversupply of uranium, coupled with low demand, set the stage for aggressive pricing by sellers. Offered prices decreased throughout September and the price decline accelerated during the final week of the month. Two producers purchased a total of 500 thousand pounds equivalent U₃O₈ as concentrates for 1990 delivery. The prices in these two mid-September sales fell several percentage points below the August 31 Exchange Value. Offered prices declined further during the rest of September, so on September 30, the Exchange Value fell even lower than the prices of the mid-month sales. Additionally, one purchase of 500 thousand pounds of concentrates that occurred earlier this year is listed among the recent transactions on page 5. It is excluded from the September 1990 data in Table 1, but has been added to the year-to-date figures.

Two long-term natural uranium sales are reported. Utilities purchased 3.8 million pounds of concentrates from producers. One contract uses base-price escalated terms for delivery during 1991-2000. The other contract calls for delivery during the period 1992-1997 with a market-related pricing structure.

* * *

The UF₆ Value dropped 8.5 percent, to \$29.50 per kgU as UF₆. This \$2.75 decline is the UF₆ Value's largest (both percentage and absolute) since its initial publication on April 30, 1985. Although no natural UF₆ transactions are reported, by the end of the month suppliers were indicating a willingness to sell at or near the September 30 UF₆ Value.

In both the concentrates and natural UF₆ markets, strong seller competition in an environment of abundant supply and low demand led to the price decreases. Demand is particularly low for two reasons.

- Many discretionary buyers purchased material earlier in the year, as prices began to rise, in an attempt to catch the bottom of the market;
- Little firm demand exists, and the few remaining discretionary buyers, seeing offered prices falling steadily, are waiting to make purchases.

As a result, sellers are likely to pursue each opportunity aggressively in the fourth quarter.

Compared to the sum of the values of its components—concentrates and conversion—the UF₆ Value is now more

Table 1
NEAR-TERM URANIUM SALES SUMMARY

	September 1990		Year-to-Date	
	No. of Sales	Volume ¹	No. of Sales	Volume ¹
Concentrates	2	0.5	50	20.1
Natural UF ₆	0	0.0	27	9.5
EUP	2	0.3	11	4.5
Total	4	0.8	88	34.1

¹ Million Pounds Equivalent U₃O₈

MARKET REVIEW

Table 2
NEAR-TERM SUPPLY/DEMAND SUMMARY

	Active Supply ¹	Active Demand ¹
• Natural Uranium ² (thousand lbs equivalent U ₃ O ₈)	5,260	750
• Supply/Demand Ratio:	7.0	
• Loan (thousand lbs equivalent U ₃ O ₈)	8,745	0
• Conversion (thousand lbs U as UF ₆)	0	1,060
• SWU (thousand SWUs)	435	225

¹ Supply and demand tables in the current market data section of this Report provide details for each category.
² Includes concentrates and hexafluoride.

in balance than at any time in the past year. UF₆ is now selling at a discount of less than one percent compared to its components. Earlier in the year, an abundance of UF₆ relative to concentrates existed and this led to discounts of nearly two dollars per kgU. Now, with the supply of both concentrates and UF₆ more in balance, the discount on UF₆ compared to its component values has diminished significantly.

The **Transaction Value** rose \$0.60, to **\$11.40** per pound U₃O₈ based on 15 transactions over 3 months involving 3.7 million pounds equivalent U₃O₈. The current Transaction Value reflects the higher prices of recent months. By averaging qualifying transactions over three months, the calculation smooths rapid market fluctuations.

Active uranium supply eased slightly, to **5.3** million pounds equivalent U₃O₈. **Active uranium demand** declined to **750** thousand pounds equivalent U₃O₈, resulting in a **supply/demand ratio** of **7.0**. The recent Uranium Institute and US Council for Energy Awareness conferences enhanced recognition of the market's enormous inventory overhang. Although only moderate amounts are actively available for sale, much larger

amounts, from any of several national stockpiles, could be moved into the market on short notice. Thus, many buyers and sellers expect this oversupply to continue.

The **Loan Rate** remains at **3.5** percent per annum. No loans are reported. Loan supply increased to 8.7 million pounds equivalent U₃O₈ (**Table 2**), while demand for loans remained at zero.

The **Conversion Value** remains at **\$1.45** per pound U as UF₆. No conversion transactions are reported, although one European utility is evaluating offers for nearly 500 thousand pounds of conversion services. Ample natural uranium is available, both in the form of concentrates and UF₆. Supply of conversion may appear low, but more than enough UF₆ is available to meet demand, by means of deconversion transactions.

ENRICHMENT SERVICES AND ENRICHED URANIUM PRODUCT

The September 30 **SWU Value** is unchanged at **\$50** per SWU. Three secondary market sales involved 70 thousand SWU. In one, a US utility purchased a small quantity of SWU for delivery later this year. The other two sales involved EUP; intermediaries sold material containing over 100 thousand kgU as natural UF₆ and over 50 thousand SWU to a fabricator and a utility.

The US Government's FY1991 began on October 1, 1990. This date marks the end of the Incentive Price (IP1) contracts, and the start of IP2 contracts. The updated IP2 price estimate is \$100.60 and is shown in **Table 3**.

Enrichment Lead Times and Fabricator Flexibility

Flexibility of fabricators to meet special customer needs has become a key factor in the secondary enrichment market. For example, SWU buyers occasionally need to give sellers less than the 180-day lead time that was once the industry standard. In past years, the buyer would have been at the mercy of the enricher, without whose cooperation such a request could only have been filled by coincidence; that is, if an inventory holder happened to have on hand enough material at the desired assay and was willing to sell or loan the material on short notice.

MARKET REVIEW

However, their enhanced flexibility now allows fabricators to offer buyers more possibilities for satisfying special needs. Total lead time for the secondary enrichment market is defined by the interval between the time the buyer orders its desired quantity and assays and the time that fabricated fuel is delivered to the reactor site. If a short lead time is needed, the fabricator's flexibility to reduce its turnaround time becomes vital. Three factors have combined in recent years to enhance that flexibility.

- Most fabricators have developed enrichment blending capabilities.
- Fabricators have accumulated large and varied inventories of EUP and have used innovative inventory management techniques to better control their enriched uranium stockpiles.
- Over time, fabricators' customers have come to accept the fungibility of enriched uranium.

At first, fabricators took the initiative, asking some customers to deliver enriched UF₆ with assays different

from those specified in their contracts. For instance, instead of providing UF₆ enriched to 3.5 w/o and 3.8 w/o as specified in the design for its reload, the utility would be asked to provide an equivalent amount of material enriched to 4.0 w/o. The delivered material would contain the same number of SWU as the contracted material. However, because the delivered material's natural uranium content would differ from the contracted amount, an adjustment would be made. Such adjustments could be made with cash, but typically involve material. In the example, the utility would have delivered natural UF₆ sufficient to compensate for the reduced natural uranium component of the 4.0 w/o material. The fabricator might then use its working inventory, together with UO₂ blending, to make the utility's fuel and apply the material delivered by the utility to another project. Now, utilities are taking the initiative, asking fabricators if they will accept a different assay, or if the fabricator can meet a shorter lead time if the utility pays a premium. In such an event, the utility would

receive its fabricated material on schedule, but actually deliver an equivalent amount of enriched UF₆ at a later date than normal.

The primary enrichers are also reducing lead times. For example, DOE has offered its customers 120-day lead times for standard assays, and 150-day lead times for non-standard assays.

These developments in the primary market will lead to more frequent requests for shorter lead times in secondary enrichment transactions. Even so, purchases with short lead times can still be expected to command prices above prevailing levels, because they represent departures from standard practice. ■

Table 3
ENRICHMENT PRICES
(September 30, 1990)

Prices	This Month Report 266	Last Month Report 265	12 Months Ago Report 254
NUEXCO SWU Value (\$US per SWU)	50	50	63
US DOE SWU prices: (\$US per SWU)			
USEC	117.85 ¹	117.85 ¹	117.00 ²
AFC	153.00 ³	153.00 ³	153.00 ³
Requirements	157.00 ³	157.00 ³	157.00 ³
Incentive Price (IP2) ⁴	100.60 ⁴	90.00 ⁵	90.00 ⁵
Calculated worth of enriched UF₆: (\$US per KgU as UF ₆)			
2.0 w/o U ₂₃₅	207	222	228
2.5 w/o U ₂₃₅	285	304	317
3.0 w/o U ₂₃₅	366	389	408
3.5 w/o U ₂₃₅	447	475	501
4.0 w/o U ₂₃₅	530	562	596
4.5 w/o U ₂₃₅	614	650	692

¹ Effective 10/1/89 to 9/30/91.

² Effective 10/1/87 to 9/30/89.

³ Effective since 10/1/84.

⁴ IP2: Effective 10/1/90 to 9/30/91, for up to 30% of annual requirements.

⁵ Uses Incentive Price IP1 - effective 10/1/86 to 9/30/90, for up to 30% of annual requirements.

⁶ Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 w/o tails assay.

MARKET REVIEW

RECENT TRANSACTIONS

Uranium Sales ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U ₃ O ₈)	Price Within Percentage Range ² of Current Exchange or UF ₆ Value	Buyer	Seller	Remarks
4945	1992-1997	1,001-3,000	See Remarks	Utility	Producer	Market Related Pricing
4946	1991-2000	1,001-3,000	See Remarks	Utility	Producer	Base Price Escalated
4947	1990	301-600	R	Producer	Producer	Occurred Earlier in 1990
4948	1990	101-300	103-110	Producer	Intermediary	
4951	1990	101-300	103-110	Producer	Intermediary	
4953A	1991	101-300	R	Utility	Intermediary	Contained in EUP
4955A	1991	Less than 50	R	Fabricator	Intermediary	Contained in EUP
R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality. ¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information. ² The ranges <i>Below 90, 90-97, 98-102, 103-110, Above 110</i>, represent percentages (rounded to whole numbers) of the appropriate current Exchange Value or UF₆ Value. The endpoints of each range are included within that range.						



MARKET REVIEW

RECENT TRANSACTIONS

Natural Uranium Loans ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U ₃ O ₈)	Price Within Percentage Range ² of Current Loan Rate	Borrower	Lender	Remarks
<i>No loans are reported.</i>						
Conversion Sales ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U equivalent)	Price Within Percentage Range ² of Current Conversion Value	Buyer	Seller	Remarks
<i>No conversion transactions are reported.</i>						
Enrichment Sales ¹						
NUEXCO Transaction Number	Delivery Period	Approximate Quantity ³ (thousand SWU)	Price Within Percentage Range ² of Current SWU Value ⁴	Buyer	Seller	Remarks
4950	1990	Less than 50	98-102	Utility	Intermediary	
4953B	1991	50-100	R	Utility	Intermediary	Contained in EUP
4955B	1990	Less than 50	R	Fabricator	Intermediary	Contained in EUP
R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality. ¹ Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information. ² The ranges <i>Below 90, 90-97, 98-102, 103-110, Above 110</i>, represent percentages (rounded to whole numbers) of the appropriate current Market Value. The endpoints of each range are included within that range. ³ If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 w/o tails assay. ⁴ Prices are usually normalized to 0.30 w/o tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.						

MARKET REVIEW

SUPPLY AND DEMAND

Uranium Supply				
NUEXCO Project Number	Quantity (Thousand Pounds equivalent U ₃ O ₈)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Available for Sale:				
ACTIVE				
89-1001	1,305	—	1991	UF ₆
90-1078A	2,175	2,175 per year	1991-1993	UF ₆ e
90-1208*	280	—	1990	UF ₆
90-1227*	500	—	1990	
90-7001	1,000	1,000 per year	1991-1995	
Total	5,260			
INACTIVE				
	2,850			
Available for Loan:				
ACTIVE				
88-1182	4,000	—	—	U ₃ O ₈ /UF ₆
90-1016	300	—	—	U ₃ O ₈
90-1033	1,270	—	—	UF ₆
90-1108	1,000	—	—	U ₃ O ₈
90-1110	250	—	—	U ₃ O ₈
90-1180	525	—	—	U ₃ O ₈
90-1212*	400	—	—	U ₃ O ₈
90-1230*	1,000	—	—	U ₃ O ₈
Total	8,745			
INACTIVE				
	1,390			
* New or revised since last month.				
¹ For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.				
² For delivery beyond one year, measured from the date of this Report.				
Active Projects reclassified as Inactive since last month: none				
Active Projects removed since last month: 90-1183				

MARKET REVIEW

SUPPLY AND DEMAND

Uranium Demand				
NUEXCO Project Number	Quantity (Thousand Pounds equivalent U ₃ O ₈)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Inquiries to Purchase:				
ACTIVE				
90-1100A	45	—	1991	UF ₆ e
90-1182	25	—	1991	
90-1207*	100	—	1990	U ₃ O ₈ /UF ₆
90-1209*	280	—	1991	UF ₆
90-1210*	100	—	1990	U ₃ O ₈ /UF ₆
90-1229*	200	—	1991	
90-1098	—	250 per year	1992-1994	
90-1155	—	325 per year	1991-1995	
90-1170	—	290	1992-1996	
90-1205*	—	260 per year	1992-2001	UF ₆
90-1206*	—	390 per year	1993-2001	UF ₆
90-1215*	—	260 per year	1993-1997	U ₃ O ₈ /UF ₆
Total	750			
INACTIVE	2,080			
Inquiries to Borrow:	<i>No inquiries to borrow are reported.</i>			
* New or revised since last month.				
¹ For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.				
² For delivery beyond one year, measured from the date of this Report.				
Active Projects removed since last month: 90-1177A, 90-1199.				

MARKET REVIEW

SUPPLY AND DEMAND

Conversion Supply And Demand				
NUEXCO Project Number	Quantity (Thousand Pounds U as UF ₆)		Remarks	
	Within 3 Years ¹	Beyond 3 Years ¹		
Available for Sale:		No offers to sell are reported.		

MARKET REVIEW

SUPPLY AND DEMAND

SWU Supply And Demand				
NUEXCO Project Number	Quantity (Thousand SWUs)		Delivery Period	Remarks
	Spot or Near-term ¹	Intermediate or Long-term ²		
Available for Sale:				
ACTIVE				
90-1078B	435	435 per year	1991-1993	UF6e
90-7000	—	1,000	1991 on	
Total	435			
INACTIVE	None reported.			
Inquiries to Purchase:				
ACTIVE				
90-1100B	15	—	1991	UF6e
90-1224*	60	100 per year	1992-1994	
90-1225*	150	—	1991	
88-1061	—	500	1991-1995	
90-1076	—	350 per year	1992-1998	
90-1094	—	500	1992-2000	
90-1144	—	60 per year	1992-2001	
90-1181	—	600	1996-2003	UF6e
90-1196	—	60 per year	1995 on	
Total	225			
INACTIVE	1,545			

* New or revised since last month.

¹ For delivery within one year, measured from the date of this Report. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

² For delivery beyond one year, measured from the date of this Report.

Active Projects removed since last month: 90-1177B

MARKET REVIEW

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

Exchange Value ¹						
Country (currency)	per lb equivalent U ₃ O ₈ as Concentrates			per kg U as Concentrates		
	This Month (Sept. 30, 1990)	Last Month (Aug. 31, 1990)	12 Months Ago (Sept. 30, 1989)	This Month (Sept. 30, 1990)	Last Month (Aug. 31, 1990)	12 Months Ago (Sept. 30, 1989)
Australia (dollar)	12.22	13.98	12.42	31.77	36.35	32.30
Belgium (franc)	324.55	368.29	379.30	843.76	957.46	986.09
Canada (dollar)	11.67	13.13	11.33	30.33	34.14	29.47
EEC (ecu)	7.69	8.68	8.77	19.99	22.56	22.80
Finland (markka)	37.37	42.22	41.27	97.15	109.77	107.30
France (franc)	52.73	60.12	61.22	137.09	156.29	159.17
Italy (lira)	11,796	13,294	13,149	30,668	34,561	34,184
Japan (yen)	1,393	1,652	1,347	3,622	4,294	3,503
Netherlands (guilder)	17.77	20.21	20.39	46.20	52.54	53.00
So. Africa (comm. rand)	25.96	29.32	26.27	67.50	76.23	68.28
Spain (peseta)	986.81	1,118	1,155	2,565	2,907	3,004
Sweden (krona)	58.01	65.96	61.98	150.82	171.47	161.12
Switzerland (franc)	13.06	14.83	15.65	33.96	38.56	40.69
UK (pound)	5.37	5.97	5.96	13.97	15.52	15.48
US (dollar)	10.10	11.45	9.60	26.26	29.77	24.96
West Germany (mark)	15.77	17.94	18.06	40.99	46.63	46.95

Transaction Value ¹						
Country (currency)	per lb equivalent U ₃ O ₈ as Concentrates			per kg U as Concentrates		
	This Month (Sept. 30, 1990)	Last Month (Aug. 31, 1990)	12 Months Ago (Sept. 30, 1989)	This Month (Sept. 30, 1990)	Last Month (Aug. 31, 1990)	12 Months Ago (Sept. 30, 1989)
Australia (dollar)	13.79	13.19	12.68	35.86	34.28	32.97
Belgium (franc)	366.32	347.38	387.20	952.36	903.11	1,007
Canada (dollar)	13.17	12.39	11.57	34.23	32.21	30.08
EEC (ecu)	8.68	8.18	8.95	22.56	21.28	23.28
Finland (markka)	42.18	39.82	42.13	109.66	103.53	109.53
France (franc)	59.52	56.70	62.50	154.74	147.42	162.49
Italy (lira)	13,315	12,539	13,423	34,615	32,599	34,896
Japan (yen)	1,573	1,558	1,375	4,088	4,050	3,576
Netherlands (guilder)	20.06	19.06	20.81	52.15	49.55	54.10
So. Africa (comm. rand)	29.31	27.66	26.81	76.19	71.90	69.71
Spain (peseta)	1,114	1,055	1,179	2,896	2,742	3,066
Sweden (krona)	65.48	62.21	63.27	170.23	161.74	164.48
Switzerland (franc)	14.75	13.99	15.98	38.34	36.37	41.54
UK (pound)	6.06	5.63	6.08	15.77	14.64	15.81
US (dollar)	11.40	10.80	9.80	29.64	28.08	25.48
West Germany (mark)	17.80	16.92	18.43	46.27	43.98	47.93

¹Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

MARKET REVIEW

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

Conversion Value ¹						
Country (currency)	per lb U as UF ₆			per kg U as UF ₆		
	This Month (Sept. 30, 1990)	Last Month (Aug. 31, 1990)	12 Months Ago (Sept. 30, 1989)	This Month (Sept. 30, 1990)	Last Month (Aug. 31, 1990)	12 Months Ago (Sept. 30, 1989)
Australia (dollar)	1.75	1.77	2.46	3.87	3.90	5.42
Belgium (franc)	46.49	46.64	75.07	102.72	102.82	165.50
Canada (dollar)	1.67	1.66	2.24	3.69	3.67	4.95
EEC (ecu)	1.10	1.10	1.74	2.43	2.42	3.83
Finland (markka)	5.37	5.35	8.17	11.83	11.79	18.01
France (franc)	7.57	7.61	12.12	16.69	16.78	26.71
Italy (lira)	1,694	1,684	2,602	3,734	3,711	5,737
Japan (yen)	200.03	209.17	266.67	440.99	461.15	587.90
Netherlands (guilder)	2.55	2.56	4.03	5.63	5.64	8.89
So. Africa (comm. rand)	3.73	3.71	5.20	8.22	8.19	11.46
Spain (peseta)	141.67	141.59	228.67	312.33	312.15	504.13
Sweden (krona)	8.33	8.35	12.27	18.36	18.41	27.04
Switzerland (franc)	1.88	1.88	3.10	4.13	4.14	6.83
UK (pound)	0.77	0.76	1.18	1.70	1.67	2.60
US (dollar)	1.45	1.45	1.90	3.20	3.20	4.19
West Germany (mark)	2.26	2.27	3.57	4.99	5.01	7.88

SWU Value And UF ₆ Value ¹						
Country (currency)	SWU Value at 0.30 %/o Tails Assay			UF ₆ Value per kg U as UF ₆		
	This Month (Sept. 30, 1990)	Last Month (Aug. 31, 1990)	12 Months Ago (Sept. 30, 1989)	This Month (Sept. 30, 1990)	Last Month (Aug. 31, 1990)	12 Months Ago (Sept. 30, 1989)
Australia (dollar)	60.50	61.05	81.53	35.69	39.38	38.50
Belgium (franc)	1,607	1,608	2,489	947.94	1,037	1,175
Canada (dollar)	57.75	57.35	74.38	34.07	36.99	35.12
EEC (ecu)	38.06	37.89	57.55	22.45	24.44	27.17
Finland (markka)	185.00	184.37	270.85	109.15	118.92	127.90
France (franc)	261.06	262.52	401.79	154.02	169.33	189.73
Italy (lira)	58,398	58,052	86,290	34,455	37,443	40,748
Japan (yen)	6,898	7,213	8,842	4,070	4,652	4,175
Netherlands (guilder)	87.98	88.25	133.78	51.91	56.92	63.17
So. Africa (comm. rand)	128.53	128.04	172.37	75.84	82.59	81.39
Spain (peseta)	4,885	4,882	7,582	2,882	3,149	3,580
Sweden (krona)	287.19	288.02	406.71	169.44	185.77	192.05
Switzerland (franc)	64.67	64.78	102.72	38.16	41.78	48.50
UK (pound)	26.60	26.07	39.08	15.69	16.81	18.45
US (dollar)	50.00	50.00	63.00	29.50	32.25	29.75
West Germany (mark)	78.05	78.32	118.51	46.05	50.52	55.96

¹ Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

RECENT DEVELOPMENTS

Germany

Consolidation of German Electric Utilities

On October 3, 1990, Germany officially became one country again, after 45 years of division. One of the many steps toward this unification was the consolidation of systems for the generation and distribution of electricity. On August 22, West Germany's electric utilities signed a contract with the East German government establishing the basic plan for restructuring East Germany's electricity supply industry. The three largest electric utilities in West Germany will acquire a majority interest in most of East Germany's electricity production and distribution, both at the high-voltage, national grid level and at the low-voltage, regional distribution level.

Before the contract was signed, three national companies supplied power to East Germany's regional electricity distributors.

- *Vereinigte Kraftwerks AG Peitz (VKP)* was responsible for conventionally-produced electricity, 85 percent of which was produced from brown coal.
- *VE Kombinat Kernkraftwerke (KKW)* operated all nuclear power plants.
- *Verbundnetz AG (VERB)* handled the national distribution of electricity.

West Germany's three largest electric utilities, Bayernwerk AG, Preussenelektra AG, and RWE AG, formed a new company named Vereinigte Energiewerke (VEAG) which will operate VKP and VERB in a caretaker role for the remainder of 1990. During this same period, VKP and VERB will be combined into one entity. Starting in 1991, VEAG will acquire a 75-percent interest (the limit imposed by the contract) in that new entity. The East German State Trust Agency responsible for privatization, modernization, or dissolution of East German companies will acquire the remaining 25-percent interest of the new company. Of that 25-percent interest, the Agency will offer 60 percent (15 percent of the total) for sale to other European Community investors.

The East German Trust Agency and RWE, through its wholly-owned subsidiary Rheinbraun AG, have already set up a new company (Lausitzer & Mitteldeutschen Braunkohlen) to handle modernization and privatization of the East German brown coal production centers. Rheinbraun has a 60-percent interest in this new company and the trust agency has a 40-percent interest.

The three West German utilities have agreed to make an immediate investment of DM1.9 billion (US\$1.2 billion) in VKP and VERB, for improvements and repair. Karl-Mermann Steinberg, East German Minister of Environment & Nuclear and signatory of the contract for East Germany, estimates that bringing the East German systems up to West German standards will ultimately cost DM40 billion (US\$25 billion).

The three West German utilities have chosen not to assume the responsibility for KKW. Therefore, the new federal government will assume responsibility for the East German nuclear power industry.

The contract allows the utilities after 1990 to acquire an interest in the regional electricity distribution areas. East Germany has 15 regional electricity (low-voltage) distribution areas—*East Berlin, Chemnitz, Cottbus, Dresden, Erfurt, Frankfurt (Oder), Gera, Halle, Leipzig, Magdeburg, Neubrandenburg, Potsdam, Rostock, Schwerin, and Suhl*. The contract limits the three West German utilities' total interest in these distribution areas to about 60% of the total East German electrical demand. The three large West German utilities plan to take a 51% interest in 11 of these 15 regional electricity distribution areas. The Trust Agency will hold the remaining 49% interest, which it can then sell to other companies in the European Community. Electricité de France (EdF) has indicated a strong desire to obtain such an interest, and has taken the lead in a consortium of European electricity producers to acquire an interest. In return, Germany expects to be able to acquire an interest in other European electrical industries.

RECENT DEVELOPMENTS

Each West German utility will set up another new corporation to handle that utility's interests in its given distribution areas. **Figure 1** shows which utilities gained either majority or minority interests, through their new corporations, in particular distribution areas. If two of the West German utilities share the majority interest in a region [such as Erfurt, Frankfurt (Oder), or Chemnitz], they will allocate that 51% among themselves in a separate agreement. The Trust Agency will still control the remaining 49% interest.

Six of West Germany's smaller electric utilities will invest in the other four regional electricity distribution areas. The six utilities are:

- Hamburgische Elektrizitätswerke;
- Energie-Versorgung Schwaben AG;
- Vereinigte Elektrizitätswerke Westfalen AG;
- Badenwerke AG;
- Isar-Amperwerke AG;
- Berliner Kraft und Licht AG.

Figure 1 also shows these six utilities' percentage interests in the four regional electricity distribution areas.

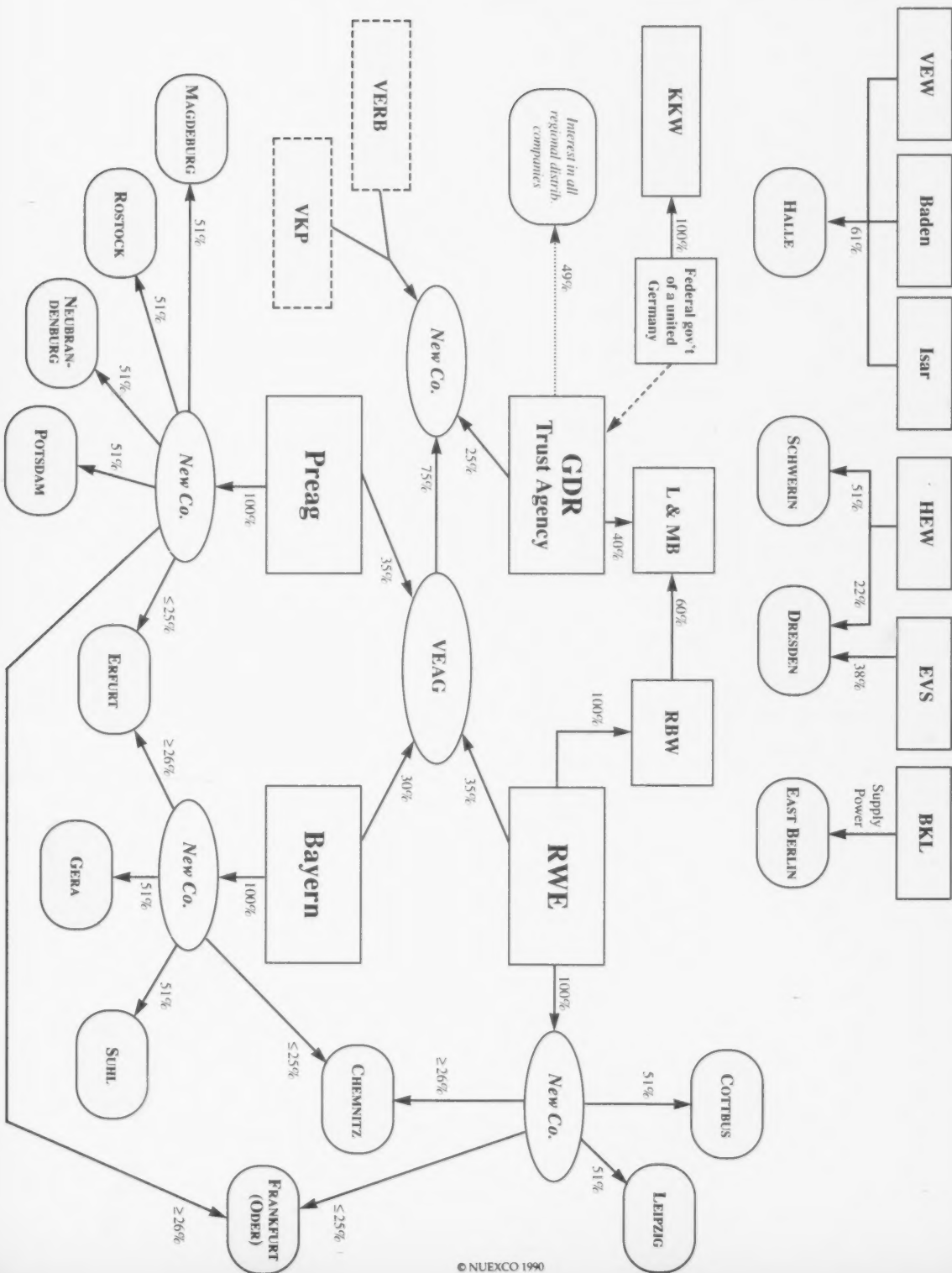
An earlier bid by the three large utilities for East Germany's electric power industry had prompted the smaller utilities to complain to anti-cartel authorities that the smaller utilities were being closed out of any interest in East Germany. Anti-cartel authorities in both Germanies refused to approve the original bid. When that bid was refused, the smaller West German utilities (except Isar-Amperwerke) submitted their own bid to East Germany's state trust.

The East German trust agency held further negotiations with the three largest utilities, which resulted in a contract with an allowance for other investors, such as smaller West German utilities, or other European/non-German investors. No information is yet available as to whether the contract restricts the current investors from reselling all or part of their interests.

Legend for Figure 1

GDR	— German Democratic Republic (Trust Agency)
RWE	— RWE AG
Preag	— Preussenelektra AG
Bayern	— Bayernwerke AG
RBW	— Rheinbraun AG
VEAG	— Vereinigte Energiewerke AG
L & MB	— Lausitzer & Mitteldeutschen Braunkohlen
KKW	— VE Kombinat Kernkraftwerke
VERB	— Verbundnetz AG
VKP	— Vereinigte Kraftwerks AG Peitz
VEW	— Vereinigte Elektrizitätswerke Westfalen AG
HEW	— Hamburgische Elektrizitätswerke
EVS	— Energie-Versorgung Schwaben AG
BKL	— Berliner Kraft und Licht
Baden	— Badenwerke AG
Isar	— Isar-Amperwerke AG

RECENT DEVELOPMENTS



RECENT DEVELOPMENTS

USA

Rosita Project Initiates Production

Uranium Resources, Inc. (URI) began operating the Rosita solution mine on September 4, 1990. The mine, located 60 miles west of Corpus Christi, Texas in northeastern Duval county, is the latest in a series of in-situ leach production facilities developed by the company.

The Rosita Project (formerly named the Rogers Project) was discovered in the mid-1970s by Union Carbide Corporation (UCC). UCC implemented a comprehensive drilling program at that time. In 1980, Chevron Resources Company (CRC) acquired the leases from UCC for about \$5.0 million. During 1980-1981, Chevron drilled more than 2000 rotary holes and 70 core holes in the leasehold area. Through this evaluation and coring program, Chevron's objective was to establish the mineability of the ore. Because the deposit is shallow (less than 250 feet), Chevron considered the Rogers Project as a potential open-pit operation. At that time, CRC calculated total in-place reserves at 3.8 million pounds equivalent U₃O₈.

URI acquired the project leases from the landowners in late 1985. The company purchased the drill data from CRC at the same time. Moreover, URI acquired additional leases adjacent to the initial project. The Rosita property now encompasses more than 3,500 acres. Total project in-place proven reserves amount to 6.2 million pounds equivalent U₃O₈.

URI received all necessary permits and licenses by mid-1989 and commenced process facility construction and well-field planning. Total capital cost for facility development was estimated at \$4.0-4.5 million. Rosita will be operated as a semi-independent production facility (2500-2800 gallons per minute). The filter-pressed concentrates will receive final drying at

URI's Kingsville Dome Project, located in central Kleberg County, Texas, approximately 70 miles away.

The initial well-field area contains a total of 205 wells (103 production and 102 injection wells) at depths averaging 220 feet. Anticipated average flow rates for the production wells will be 20-25 gallons per minute over the well-field life. The well patterns have been installed in two configurations in order to determine the most efficient layout for future production areas. New wells will be installed at a rate to maintain the annual production rate of 800-900 thousand pounds equivalent U₃O₈ following the initial year's output of an estimated 1.0 million pounds equivalent U₃O₈. Well installation for the second production area is scheduled to begin in November, 1990.

URI intends to conduct necessary restoration on an ongoing basis by utilizing reverse osmosis. This concept is a departure from traditional solution mines, where restoration is usually initiated following the cessation of active production.

Dustin Garrow



Figure 1 — Central recovery plant at the Rosita ISL Project in southern Texas.

NPT Conference

NPT Review Conference Ends Without Consensus

On September 15, the Fourth Review Conference on the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) concluded without a final consensus document agreed to by all of the delegates. The failure of the 142 NPT signatory nations to reach an agreement does not bode well for the 1995 conference. The current treaty expires in 1995, and that final conference must decide whether to extend the treaty (and for how long), modify it, or let it expire and try to create a new treaty more acceptable to all nations.

The conference began on August 20 and was scheduled to run for four weeks. Since the last review conference in 1985 (reviews are held every five years), significant progress had been made in areas covered by the treaty—the fall of the Iron Curtain, the signing of the INF treaty, major progress on a START treaty, and reduced fears regarding the intentions of non-signatory states such as Argentina, Brazil, and South Africa. South Africa has even recently announced that it intends to sign the NPT soon, provided other nations in southern Africa also sign. Additionally, two non-signatory, nuclear weapon states (NWS), France and China, asked and were granted permission to attend the conference as observers. This development, the first time either nation had even attended, was a positive sign for the future of the treaty. So although there were new concerns, such as transfers of ballistic missiles to non-nuclear weapons states (NNWS) and proliferation concerns about countries such as Iraq and North Korea, the conference began optimistically. A successful conference would set an important precedent for the 1995 conference.

Before the conference began, eight key issues needed to be carefully addressed to reach a consensus on a final document.

- **Conditions of Nuclear Trading**—In the past, this point was frequently discussed, because the non-discriminatory intentions of the NPT often conflicted with the conditions imposed by suppliers of nuclear power technology. Suppliers often want complete safeguards of all nuclear activities related to the material they supplied, yet others

oppose too much interference with trade that would limit the access to technology many NNWS states desire.

- **Compliance with Articles I and II of the Treaty**—Have all NWS and NNWS met their obligations not to transfer nuclear weapons and technology to other countries, and not to develop nuclear weapons? Delegates raised questions about the intentions of Iraq, North Korea, and Israel, and all of the NWS.

- **Compliance with Article IV of the Treaty**—Have the NWS demonstrated their commitment to nuclear arms reductions? Considerable progress has been made in the past five years on nuclear weapons disarmament agreements. But debate about Test Ban Treaties became the major issue of the conference.

- **Additional Security Assurances**—NNWS want further assurances that the NWS will not use or threaten to use nuclear weapons against NNWS.

- **Changes to the IAEA Safeguards System**—The conference needed to discuss how the IAEA safeguards against diversion of nuclear material can continue to operate effectively in an era of zero-growth budgets.

- **Nuclear Weapon-Free Zones**—Article VII of the NPT permits regional treaties to assure the total absence of nuclear weapons. These treaties often raise questions of the geographical status of the zone and whether peaceful nuclear explosion testing is permitted. This issue is always controversial and potentially divisive.

- **Assurances against Attacks on Nuclear Plants**—This issue is most troublesome within the Middle East; each side accuses the other of attacks or plans of attack. Without guarantees against attack, states would be reluctant to invest in costly nuclear energy projects, thereby inhibiting the growth of nuclear power.

- **The 1995 Extension Conference**—The NPT does not outline how long to extend the treaty, only that a meeting to decide this issue is to be convened for such a purpose after 25 years. The 1990 conference was important to set the stage for this meeting.

Most of these key issues were handled effectively during the conference. The main issue that ended up causing difficulties was the issue on compliance with Article IV—Nuclear Arms Reductions. This issue was not expected to

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be so complex. Recent progress on START negotiations, the signing of the INF Treaty, and the fall of the Iron Curtain were viewed by many as a solid demonstration of progress on nuclear arms reduction.

However, a small group of nations, led by Mexico, insisted on a comprehensive test ban treaty (CTBT) prohibiting all testing of nuclear weapons worldwide. The overwhelming majority of the NPT signatories were satisfied with progress on Article IV and did not feel a CTBT was worth risking the entire success of the conference. Extensive negotiations and proposals began with two weeks remaining at the conference. By the final week, the CTBT issue had emerged as the key element blocking a consensus Final Document. In the final two days, the nations of Syria, the Phillippines, Venezuela, Sri Lanka, and Uganda, which originally supported the CTBT issue, had agreed to a compromise. But by the end of the conference, Mexico, Indonesia, and Iran still insisted that nuclear arms control would not be possible without a CTBT. Even after last-ditch compromise language was proposed in order to develop a Final Document, Mexico still refused to consent and the conference ended unsuccessfully.

Conclusion

Regretfully, the lack of a consensus Final Document prevents progress made in other areas from being enacted. By the end of the conference, Belgium, Switzerland, Italy, Great Britain, and the Soviet Union had all agreed to draft language accepting full-scope safeguards. This would have complemented Germany's recent announcement that it would accept full-scope safeguards.

The lack of a Final Document does not doom the NPT, but does put added pressure on the 1995 conference. That conference will probably be the most important world meeting on nuclear weapons ever held. A majority of the 142 signatory nations must agree to extend the treaty for a certain amount of time. The NPT remains the cornerstone of nuclear non-proliferation and its contribution to global security is unequalled. The Treaty is now 20 years old and must evolve to meet changing world conditions. It will be up to the participants of the 1995 conference to preserve the intentions of the NPT and conclude the tough compromises necessary from all nations. ☐

Uranium Institute Symposium '90

Introduction

The Uranium Institute held its Annual Symposium on September 5-7, 1990, in London. As addressed by keynote speaker, Dr. Kunihiro Uematsu, the future of nuclear energy was the primary theme of the conference. The growing realization of the need for more energy, and concerns about the environment, make nuclear power an alternative that must be seriously considered. The Symposium looked at many facets of the fuel cycle, from supply and demand to reprocessing. Overviews of selected papers are presented in the following paragraphs.

Mr. Gerald Grandey, President of Energy Fuels and Chairman of the UI Committee on Supply, Demand, and Trade presented an update of the committee's uranium forecast through the year 2005. Reactor requirements are expected to grow slightly, rising to about 52,000 MTU per year by the year 2000 and remain steady thereafter. Production is forecast to be near 43,000 MTU per year. Any shortfall will be made up from existing inventories. With inventory drawdowns existing and expected production, new supplies from the Soviet Union and China, and reprocessing, the committee projects that a uranium shortfall is unlikely to develop during the 1990's.

Mr. Doug Underhill, Manager of the Mineral Resources Division of the Nuclear Assurance Corporation (NAC), spoke of uranium exploration programs and their outlook for the 1990's. He described how exploration efforts are directly correlated to the spot market price. As the price dropped during the 1980's, after all-time high levels in the late 1970's, exploration dropped as well. Exploration expenditures by WOCA countries are at only 15% of their 1979 peak levels. Companies have compensated by acquiring new resources, not discovering them. NAC believes if spot market prices remain low through the mid-1990's, and consequently, if exploration expenditures also remain low, the delay in discovering new reserves could prove troublesome by the turn of the century.

Ms. Heera Clark, Vice-President of Marketing and Consulting at the Uranium Exchange Company, discussed uranium procurement practices of US and non-US utilities. US utilities have been put under pressure from ratepayers, government officials, shareholders, and Public Utility Commissions to keep costs down. This pressure, when combined with the abundance of supply, led many US utilities to purchase their uranium requirements on the spot market and make security of supply a minor consideration. In contrast, non-US utilities still value and depend upon diverse and secure sources of supply, and are willing to pay premium prices to assure its existence. The result is that some producers are being effectively subsidized by the higher-priced long-term contracts of non-US utilities, and US utilities are benefitting by getting lower prices on the spot market and still being assured of supply. During the 1990's, this situation may change slightly, with each side approaching the middle. Ms. Clark does not project that the uranium market will become a true commodities market during the 1990's, without regard to assurance of supply, but states that all market participants would be better off in the long run if the uranium market began to more closely follow the laws of actual supply and demand.

Dr. John Gittus, Director-General of the British Nuclear Forum (BNF), spoke first during one of the most interesting sessions of the symposium. He discussed evolving British attitudes toward nuclear power. Using some of the results of the surveys that the BNF (formerly the Nuclear Electricity Information Group) has been taking in the UK since May 1986 (just after Chernobyl regarding nuclear power, Dr. Gittus described how trends of favor or disfavor were directly affected by recent events. A negative announcement (Chernobyl, Sellafield medical effects) resulted in a lower acceptance, as would be expected. While no solid conclusions can yet be drawn regarding nuclear power, the surveys have proven successful enough that they can be used to help the industry improve the acceptability of nuclear power.

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Dr. John Durant, Assistant Director and Head of Research and Information Services at the Science Museum of London, addressed public perception of civil nuclear power. He discussed studies on how people perceive nuclear power and how they perceive science and technology in general. His evidence suggests that the British public recognized the benefits of technology, but are cautious and critical of sciences that they view as immoral or unsafe. Nuclear power is an example of a technology that the public does not understand very well, and consequently, views with caution. The industry must recognize this, and help further the knowledge of the public about nuclear power and, importantly, increase their knowledge of science and technology in general.

Dr. Ann Bisconti, USCEA Vice-President for Research and Program Evaluation, discussed US public opinion in a changing energy environment. Public support of nuclear power in the US is higher than many people realize. In June 1990, 83% of the public felt that nuclear power was important in meeting future US energy needs. Growing environmental concerns and more frequent power shortages in the US, will lead the public to increase their recognition of the need for electricity and the need for clean, reliable, and affordable sources of that electricity.

Mr. Eiji Takeuchi, General Manager of the Nuclear Power Operations Department for Chubu Electric Power Company, spoke on gaining public acceptance of nuclear power in Japan. Japan has managed to get public acceptance of nuclear power by unfailing attention to

detail, demonstrating operational excellence, and by effectively communicating with the general public and with public interest groups. The Japanese government has also been very supportive. Since the Chernobyl accident, the anti-nuclear movements in Japan have become more active, and have begun appealing to the emotions, not reason, of the public. Mr. Takeuchi stated that the nuclear industry can take the following actions to further public acceptance.

- operate existing plants safely and effectively;
- provide the public with accurate and timely information;
- communicate face-to-face with the public, not just with one-way media tactics;
- address public concerns of safety and waste disposal;
- enhance nuclear safety worldwide.

Dr. Andrei Gagarinski, Deputy Director of the Kurchatov Institute of Atomic Energy in the USSR, discussed the status and prospects of nuclear power in the Soviet Union. The country continues to plan aggressively for the use of nuclear power to solve its energy problems. The Chernobyl accident set back the program significantly. The accident stopped construction at 15 sites and stopped plans on 20 more units. As a result of these delays and other factors, the Soviet Union's fuel supply system will be large enough to support a nuclear program three times as large as it will be at the end of the century. Consequently, the Soviet Union has considerable capability to export nuclear fuel materials, to obtain much-needed hard currency.

USCEA Conference

USCEA Uranium '90 Conference

The USCEA held its Uranium '90 Conference in San Antonio, Texas on September 16-19, 1990. Over 260 delegates attended and 22 papers were presented. Some of the most animated debate followed Tuesday morning's session. Several speakers put forth a utility perspective of short lead times and low inventory as a part of fuel procurement strategy, because the vast abundance of supply makes security of supply much less of a concern than in the past. Brief summaries of selected speeches are presented below.

Session 2: A Changing Supply Regime

The Australian Government's Uranium Policy

Robert J. Crick, Head of the Uranium and Nuclear Industry Branch of the Australian Department of Primary Industries and Energy, discussed the development of Australia's uranium policy. He addressed the confusion over the "three mines policy" for uranium exports, which was never intended to mean that the government would allow exports from any three mines. It more accurately should have been called the "three named mines policy", for the three mines that were in operation at the time the policy was instituted. It does not call for a replacement for the Nabarlek mine, which ceased operations in 1989. A widely-reported recent policy change in Australia was the elimination of the fixed floor-price requirement for long-term sales contracts. These and other aspects of Australia's uranium policy are currently under review by the Labor Party. The results of the review will be considered at the next regular party conference in mid-1991.

World Uranium Supply and Demand and the Potential Impact of Developments in Eastern Europe

Jan Murray, the Secretary-General for The Uranium Institute, discussed the opening of Chinese, Soviet, and East European markets, and their effect on world uranium supply and demand. Although it is no longer valid to restrict supply and demand analysis to western countries, there is little clear information available for the East European countries; in fact, uranium production data is still officially classified in the USSR. Available estimates suggest that production in the USSR is second only to Canada, and that its inventory exceeds 200 thousand tons U.

Canadian Uranium Industry

Robert Morrison, Director General for the Electricity Branch of the Canadian Department of Energy, Mines and Resources, discussed recent developments in the Canadian uranium industry and in uranium export policies. The changes are designed to promote economic development, exports, and investment in the Canadian uranium mining industry. They include: the maximum approval period on export contracts doubled to 30 years; government requirements that uranium contracts cover all future supply needs of individual Canadian utilities have been eliminated; pricing review criteria have been restated; uranium further-processing exemption criteria have been simplified; and foreign ownership limits have been increased.

Session 3: Uranium Consumers: The Utility Perspective

Nuclear Fuel Supply Implications of Ontario Hydro's Energy Supply Plan

Mr. E.G. Bazeley, Nuclear Fuel Supply Manager, reported on Ontario Hydro's demand/supply plan. Ontario Hydro utilizes demand-driven electricity growth forecasts to estimate future supply needs. In December 1989, Ontario Hydro completed its demand/supply plan; it calls for purchasing power from Manitoba, building 32 fossil fuel plants starting in 2001, and adding 10 new 880-MW reactors beginning in 2003. The utility projects it will be able to acquire the nuclear fuel necessary to meet demand without undue difficulty.

Uranium Procurement at TVO

Ilkka Mikkola, manager of TVO's Nuclear Fuel Office, discussed TVO's uranium procurement policy. Like many smaller European countries, Finland is largely dependent on imports for energy production. Thus, in contrast to some US utilities' procurement strategies, TVO places a high priority on security of supply, but within competitive constraints.

Uranium Procurement Strategy of a US Utility

Superintendent of Northern States Power's (NSP) Nuclear Fuel Supply, Jim Karalus, advocated a progressive supply program. NSP essentially maintains zero inventory as a means of lowering inventory carrying costs, and lowering purchase costs. In fact, Mr Karalus stated that if material which has not yet been paid for is deleted, NSP probably has a negative inventory. At this time, NSP does

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not view security of supply as critical, given the oversupply of uranium worldwide. NSP management emphasizes a strategy that results in the lowest costs. Flexibility to achieve the lowest costs is important, so NSP's strategy will change as market situations change.

Nuclear Plant License Renewal and its Impact on Uranium Requirements

Rudy Grube, director of Fuel Management for Yankee Atomic Electric Company, argued that nuclear plant license renewal in the US is essential; 20-year renewals would be equivalent to building 50 new nuclear plants. It would prevent the discharge of up to 11 billion tons of CO₂ and 182 million tons of SO₂ compared to the fossil fuel plants that would need to be constructed to replace nuclear electricity. License renewal would also provide electricity at one-tenth the cost of fossil plants of similar size (\$150/kw vs. \$1,500/kw). Mr. Grube emphasized that the process should be a re-licensing, not a new license procedure.

Uranium Market Trends and Utility Procurement Strategies for the '90s

Dave Clark, President of the Uranium Exchange Company, roused the emotions of many of the conference participants when he argued that security of supply should not be an issue for utilities, and that utilities should not subsidize producers with high-priced, long-term contracts. Mr. Clark said that the sooner buyers and sellers stopped being motivated by fear and greed, the sooner the laws of supply and demand can begin to work in the uranium market, which will, in turn, benefit both producers and utilities.

Session 4: Uranium Producers: The Mining Perspective

Eastern Europe's Uranium Production Capability

Wolfgang Kersting, the Managing Director of Germany's INTERURAN GmbH, covered the uranium production capability of the East European satellite countries, including East Germany, Czechoslovakia, Bulgaria, Romania and Hungary. Since 1946, most of their uranium production has been delivered to the USSR. With the recent changes in Eastern Europe, these countries will take control of their own operations, and will need to adopt western strategies to improve their efficiency and lower their costs, in order to compete in the new world market.

Namibia's Uranium Production

Michael Bates, the Chief Executive and Managing Director of Rössing Uranium Ltd., spoke about the Rössing mine, Namibia's sole uranium production operation, and the second largest uranium production operation in the world. Since Namibia gained independence from South Africa, economic sanctions on trade have been lifted. Exports from the Rössing mine account for approximately one-third the value of all exports from the new nation. Rössing's market strategy is to produce to meet contracted deliveries; once contracts exceed 10 million pounds U₃O₈ per year, Rössing has the ability to expand to meet further contracted demand.

Session 5: The International Uranium Industry: A Time of Change

Stocks and Trade with the Eastern Bloc— A Comparison of Uranium with other Metals

Alison Kidd, Senior Economist with RTZ Ltd., presented an analysis of the stocks and trade of some other base minerals (Al, Cu, Pb, Zn) and how trade with Eastern Bloc nations affected those metal markets. Because of the similarities of these markets to the uranium market, such as market oversupply, Ms. Kidd suggests that using analogies could offer an additional perspective on the effect of Eastern Bloc trade on the uranium market.

The Major Uranium Suppliers of the 1990s

Treva Klingbiel, Vice-President of NUEXCO Information Services discussed major uranium suppliers of the 1990s. Her speech is reprinted on pages 26-33 of this Report.

Uranium Resources: What's Happening in the Present Market

Mark Giroux, Uranium Market-Senior Analyst for COGEMA, raised questions on the true availability of uranium reserves in the years to come. Outlook from the consumers side is that of ample supply, with large excess inventories and the influx of material from the Eastern Bloc countries. Outlook from the producers' side is pessimistic, focusing on recent mine closures financial instability, and low uranium prices. With permitting delays and environmental concerns, the cost to restore world production capacity to the necessary future level may be higher than expected.

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WASHINGTON FOCUS

Congressional and administration negotiators concluded a five-year agreement intended to resolve the US government's budget and deficit problems as the fiscal year ended September 30. Congress must vote on the agreement and revise all 13 appropriations bills, including DOE and NRC appropriations. Increased NRC user fees and across-the-board energy taxes could be part of the final budget package. While Congress waited for the budget negotiators, work on other priority issues continued. Members considered the Clean Air bill, concluded the emissions section, and moved on to air toxics (which includes radionuclides).

Uranium Enrichment Bill's Last Chance This Year

◆ Senator Wendell Ford (D-KY) sent a message to the House that he is serious about enacting legislation restructuring DOE's uranium enrichment program. He attached the Uranium Enrichment Restructuring bill (S 83) as an amendment to two unrelated bills—a PURPA bill (Public Utility Regulatory Policies Act, S 2415), and a Federal Energy Regulatory Commission bill (S 3085). Reps. John Dingell (D-MI) and Philip Sharp (D-IN) sponsored PURPA legislation in the House, and the bill is awaiting House approval. Sen. Ford's action is designed to force Rep. Sharp to discuss uranium enrichment restructuring if he hopes to have Senate consideration of his own PURPA bill (HR 4808).

In the House of Representatives, the industry is encouraging the full Science, Space and Technology committee to hold a hearing and markup of an enrichment restructuring bill. Pressure is building to hold a hearing prior to the currently scheduled adjournment date of October 19. Unless Sen. Ford's strategy succeeds, perhaps in a lame duck session of Congress (a session held after an election but before new members are seated; members who have not been re-elected may still vote), the bill's proponents must begin the process anew next year.

Uranium Miners Compensation Bill Awaits President's Signature

◆ On September 27th, Congress approved and sent to the President for his signature, HR 2372—The Radiation Exposure Compensation Act. The bill creates a trust fund to compensate uranium miners in five Western states and citizens that lived downwind of the Nevada nuclear weapon test site in the 1940s and 1950s. UMETCO Minerals Corporation was primarily responsible for encouraging Congress to act on this bill. When the President signs the bill, it will set a precedent for federal responsibility in compensating uranium miners for cancer and other health problems resulting from practices established at the start of the nuclear weapons program.

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INDUSTRY BRIEFS

Swiss Voters Reject Phase Out, But Approve Nuclear Construction Moratorium

On September 23, Swiss voters rejected (53% to 47%) a proposal for the progressive abandonment of nuclear energy, which provides 40% of Switzerland's electricity production. However, a 55% majority approved another initiative calling for a 10-year moratorium on new nuclear plant construction or licensing. This proposal was viewed by the Swiss public as a compromise measure. Additionally, the Swiss solidly approved (71%) a measure that gives the federal government increased powers to control energy usage and requires the government to investigate alternative energy sources. Swiss voters had previously rejected anti-nuclear proposals, both in 1979 and in 1984.

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EdF Confirms Order For Civaux 1

EdF confirmed that it will order the construction of Civaux 1, a 1450-MWe (net) nuclear power unit. EdF will order the pressure vessel from Framatome in 1991. EdF probably will order Civaux 2, also a 1450-MWe (net) unit, in 1993.

NDP Surprise Victor in Ontario

The left-wing New Democratic Party (NDP), led by Bob Rae, surprised many observers by winning the majority of the seats in Ontario, Canada's September 6 provincial election. The anti-nuclear NDP took control of the government on October 1. The new energy minister will be Brian Charlton, who opposes nuclear power. He will be able to veto Ontario Hydro's recently completed 25-year energy plan, which includes plans for three new nuclear units. The ruling, pro-nuclear Liberal Party, which was in the third year of a five-year term, was trying to capitalize on recent high popularity in the polls by calling a quick election. A win would have returned them to power for five more years.

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Czechoslovakia Joins Foratom

Foratom, a non-governmental association of Western Europe's 13 national nuclear forums, announced September 4 that Czechoslovakia will become its first East European member. Foratom is likely to accept Hungary's national nuclear forum as the next.

Poland Abandons Zarnowiec

On September 4, the Polish government voted to abandon work on the reactors at Zarnowiec and to suspend any further nuclear projects until the year 2000. The two 440-MWe (net) VVERs were started in 1982, but are only 30% complete. Economic and technical problems have plagued the projects since their inception. Poland still will consider nuclear power projects for the future, and has set a goal to operate 2000 MWe of nuclear power by 2005.

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Cogema's UP3 Facility Operational

On August 26, Cogema's La Hague UP3 fuel reprocessing center became fully operational for the first time. The T1 shearing and dissolution unit had been the last incomplete process step. Most other steps in the process have been operating for some time. Cogema has contracts for approximately 7,000 MTU of reprocessing. The new line has a nominal capacity of 800 MTU per year.

RECENT DEVELOPMENTS**Wismut to Close Mining Operations**

Wismut AG announced that its mining operations, consisting of six uranium mines and one uranium mill, will be closed by 1995. Wismut, based in East Germany, is an East German and Soviet uranium producing partnership (50%/50%) that was formed in 1954. It produced about 4,000 MTU equivalent U_3O_8 in 1989 and expects to produce 3,200 MTU this year. The Soviet Union has a contract, through the end of 1990, to take delivery of uranium mined by Wismut. However, the Soviet Union has announced it will not renew the delivery contract for 1991. The Soviet Union will remain a shareholder, but is not bound to maintain its interest at the present 50% level.

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Court Rules in Favor of US Government in Yucca Mtn. Waste Site

On September 19, the 9th US Circuit Court of Appeals in San Francisco ruled 3-0 that the US government can continue examining Yucca Mountain, Nevada as a potential location for the first US high-level nuclear waste site. The court ruled that the Nevada legislature's actions to prohibit storage of high-level nuclear waste were not binding on the federal government.

Italian Government Ratifies ENEL Reactor Shutdowns

The Italian government has formally ratified a July 12 resolution of the Italian Parliament that calls for the permanent closure of ENEL's Trino Vercellese and Caorso nuclear power plants. The resolution directs ENEL to put the plants in "passive protective custody" and to prepare decommissioning plans. Italy's Ministry of Industry, and its nuclear and alternative energy research agency, ENEA, still must approve the decommissioning plans before work can proceed. The government will ultimately reimburse ENEL for the decommissioning costs.

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Seabrook Enters Commercial Operation

After years of controversy, the Seabrook Nuclear Power Plant in New Hampshire entered commercial operation at the end of August. Seabrook recently completed over five months of power ascension tests. Unfortunately, the project's legal battles have not yet come to an end.

CORRECTIONS

In the July Monthly Report, #263, the article on Nukem's ownership change needs several corrections to Figure 1 (p.14). RBW holds a 50% interest, rather than 75%, in Uranerz Exploration and Mining Ltd. Also, RBW owns a 6.25% interest in Ranger (Australia), which was not indicated. In the legend, RBW should have been identified as Rheinbraun AG, as it was officially renamed last year.

The August Monthly Report, #264, under **Saskatchewan Revises Uranium Royalty System** (p.21), contains a typographical error in the reference to the 15% royalty assessed on gross sales. The basic minimum royalty is actually 5 percent, which may be used as a credit against any graduated royalties payable.

SPEECH

THE MAJOR URANIUM SUPPLIERS OF THE 1990s

The following is an edited version of a speech presented by Treva Klingbiel, vice-president of NUEXCO Information Services, to the USCEA Uranium '90 Conference in San Antonio, Texas on September 19, 1990.

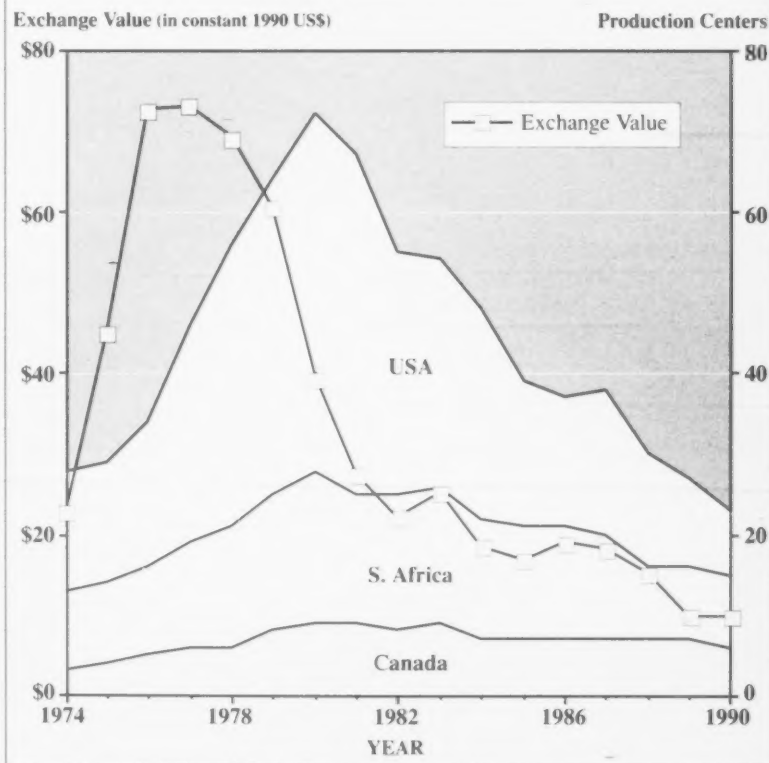
Between 1946 and 1990, the world uranium mining industry has experienced two complete boom/bust cycles. Each cycle has consisted of distinct and lengthy periods of expansion and consolidation, separated by a brief period of relative stability in the 1960s. Currently, the industry is in a consolidation phase with the strong getting stronger and the weak disappearing. A small number of producers have weathered this consolidation phase, and three have emerged as, and will likely remain, the major uranium producers in the 1990s. These three producers are: Cameco, Cogema, and RTZ.

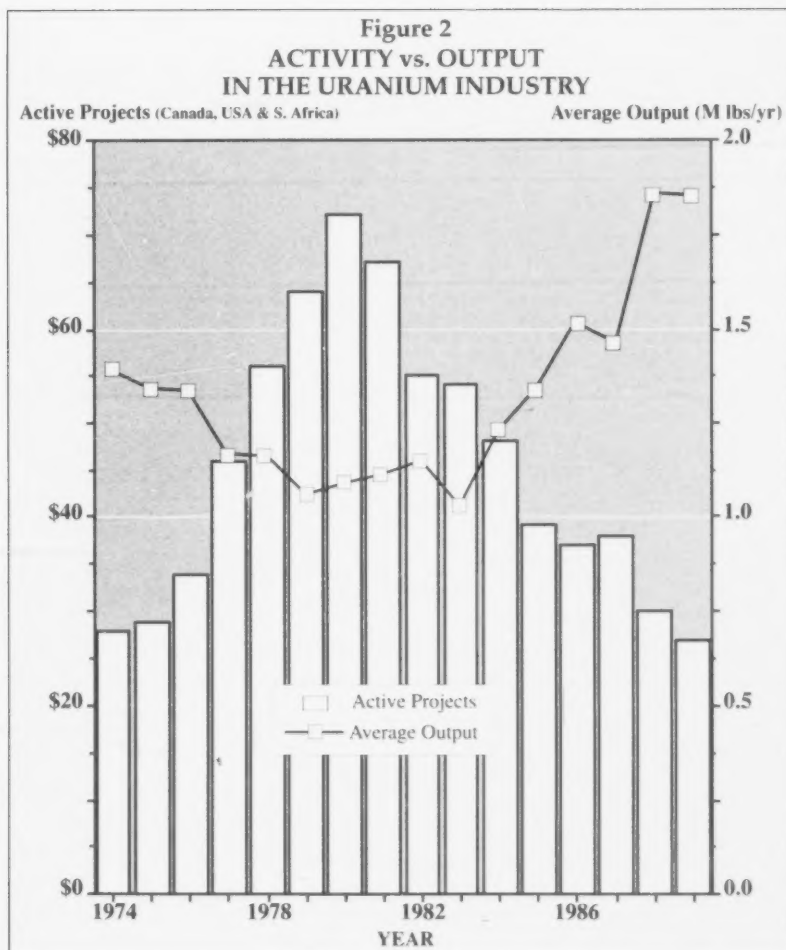
From an economic viewpoint, it is generally accepted that such a consolidation results in greater price stability. This stability derives partly from reduced competition, which would normally result in increased prices. Currently however, significant new suppliers are emerging, resulting in increased competition, which may limit any significant price rise. These key competitors are the Soviet Union, China, and the Australian producers. As a group, they represent additional strong supply participants which will compete for world market share with the new "Big 3" of the 1990s.

The Uranium Market

Increasing prices encourage investment in the construction of new facilities. Decreasing prices force closures of production facilities. This relationship of activity and price is particularly evident in the USA. **Figure 1** illustrates the correlation between uranium prices and the number of uranium production centers. An interesting corollary to this trend is shown in **Figure 2**,

Figure 1
ACTIVITY vs. PRICE
IN THE URANIUM INDUSTRY





where the average output per production center is shown to be inversely related to the number of production centers. Thus, larger production centers seem to survive better than smaller ones during periods of low prices, and indeed, this is borne out by the current period of consolidation.

NUEXCO counted a total of 57 uranium production centers in the western world in 1989. These centers produced a total of 89 million pounds equivalent U_3O_8 in 1989, an average of about 1.6 million pounds each. Much

of this production was attributable to the new "Big 3," as shown in **Figure 3**. These three companies have at least a partial interest in 19 of the 57 active projects. The net interest of Cogema, Cameco and RTZ in 1989 production was over 41 million pounds, or about 45 percent of total production (**Table 1**). On a gross basis, however, the 19 projects in which these companies participated accounted for 62 million pounds or almost two-thirds of western world supply. This gross market share is expected to decrease only slightly through at least the mid 1990s.

Of the "Big 3" uranium companies, RTZ is the one most actively engaged in a program of acquisitions designed to increase its presence in the uranium industry. RTZ, through its subsidiaries, acquired the large, but mostly inactive, US uranium holdings of Kerr-McGee in 1989; a 50-percent interest in U.S. Energy's undeveloped Green Mountain project in 1990; and an eight-percent interest (expandable to a 25-percent

interest) in the US solution mining company, Uranium Resources Inc., in 1990.

Cameco continues to add to its portfolio of properties through successful exploration efforts in Saskatchewan. It recently sold a one-third interest in its Rabbit Lake project (currently on standby) to Uranerz. Cogema is cutting back its domestic operations in France, but has added to its overseas interests in both Australia and the USA.

SPEECH

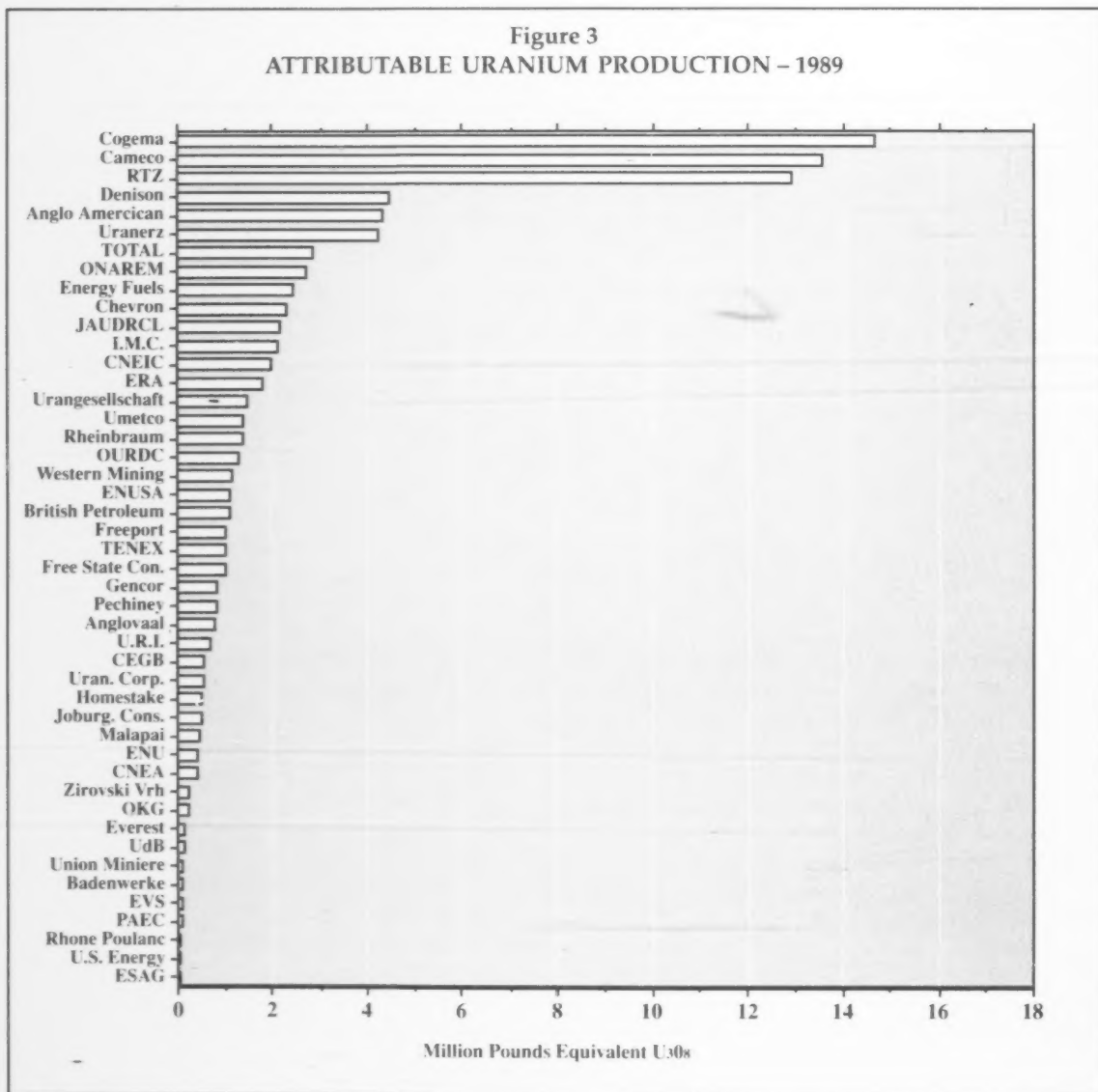
The Major Suppliers

Cogema

Cogema is a vertically-integrated uranium producer, focused on serving the French nuclear utility, Electricité de France. The ownership of Cogema is vested wholly in

the French government. From its formation in 1945 through the mid-1970s, the French Commission for Atomic Energy (CEA) dominated uranium production in France. In 1976, the CEA transferred all its exploration and mining responsibilities to a newly-formed and wholly-owned subsidiary, Cogema (Compagnie Générale des Matières

Figure 3
ATTRIBUTABLE URANIUM PRODUCTION - 1989



Nucléaires). Cogema assumed control of mining and milling operations in three districts of France, as well as exploration activities in France, Spain, Portugal, Zambia, and Australia. In addition, the company became involved in exploration, mining, and milling in Canada, Gabon, Niger, and the USA. Cogema currently has controlling interest in about 30 companies involved in various aspects of the nuclear fuel cycle, including uranium exploration, mining and milling, conversion, enrichment, fuel fabrication, spent fuel reprocessing, and other related activities.

Cameco

Cameco—A Canadian Mining and Energy Corporation, was formed in 1988 through the merger of Saskatchewan Mining Development Corporation (SMDC) and Eldorado Nuclear Limited. Cameco is the world's largest, low-cost producer of uranium, and is expected to remain in that position indefinitely. Cameco currently has interests in three major producing mines in northern Saskatchewan: Rabbit Lake (66²/₃ percent), Key Lake (66²/₃ percent), and

Cluff Lake (20 percent). The ownership of Cameco is vested in the provincial government of Saskatchewan (61.5 percent) and the federal government of Canada (38.5 percent), but a series of public offerings is scheduled to privatize the company over a period of seven years. However, the first phase of privatization has been deferred due to low uranium prices.

Cameco is a vertically-integrated producer of nuclear fuel (for the CANDU heavy-water reactor), conversion services, and enrichment services. Its recently announced partnership with Isotope Technologies for development of the CRISLA process marked Cameco's entry into the enrichment market.

RTZ

The RTZ Corporation PLC, formerly Rio Tinto Zinc Corporation PLC, is a British corporation originally formed in the 1800s to exploit copper deposits in Spain. RTZ's involvement in uranium production includes projects in Namibia, South Africa, Canada, USA, and Australia. RTZ's largest uranium production facility is the Rössing open-pit mine in Namibia which has a production capability in excess of ten million pounds equivalent U₃O₈ per year.

Notably, RTZ is the only major producer of the 1990s not directly owned by a government. Uranium accounts for only a small portion (less than five-percent) of RTZ's overall business interests, which revolve around mining and processing a wide range of other metals and minerals.

TENEX

TENEX, an acronym for V/O Technobexport, is the sole exporter of nuclear fuel components and services provided by the Soviet Union. It acts as an agent for the many producers of those items.

TENEX was founded in 1963, and until 1988 functioned within the Ministry of Foreign Trade and the Ministry of Foreign Economic Relations of the USSR. Currently, TENEX is a foreign economic organization of the Ministry of Atomic Energy and Industry. TENEX also exports a wide variety of technical products and technologies allied to both nuclear engineering and mineral production.

During the period 1945-1989, the Soviet Union built up a substantial stockpile of uranium in various forms through

Table 1
DIRECT INTERESTS IN
URANIUM PRODUCTION
OF LARGEST THREE PRODUCERS

Company	Net Share of 1989 Uranium Concentrate Production		Participation in 1989 Uranium Concentrate Production	
	Million Pounds U ₃ O ₈	% of WOCA Supply	Million Pounds U ₃ O ₈	% of WOCA Supply
Cameco	13.5	15%	19.3	21%
Cogema	15.0	16%	28.0	30%
RTZ	12.9	14%	15.0	16%
TOTAL	41.4	45%	59.51	64%

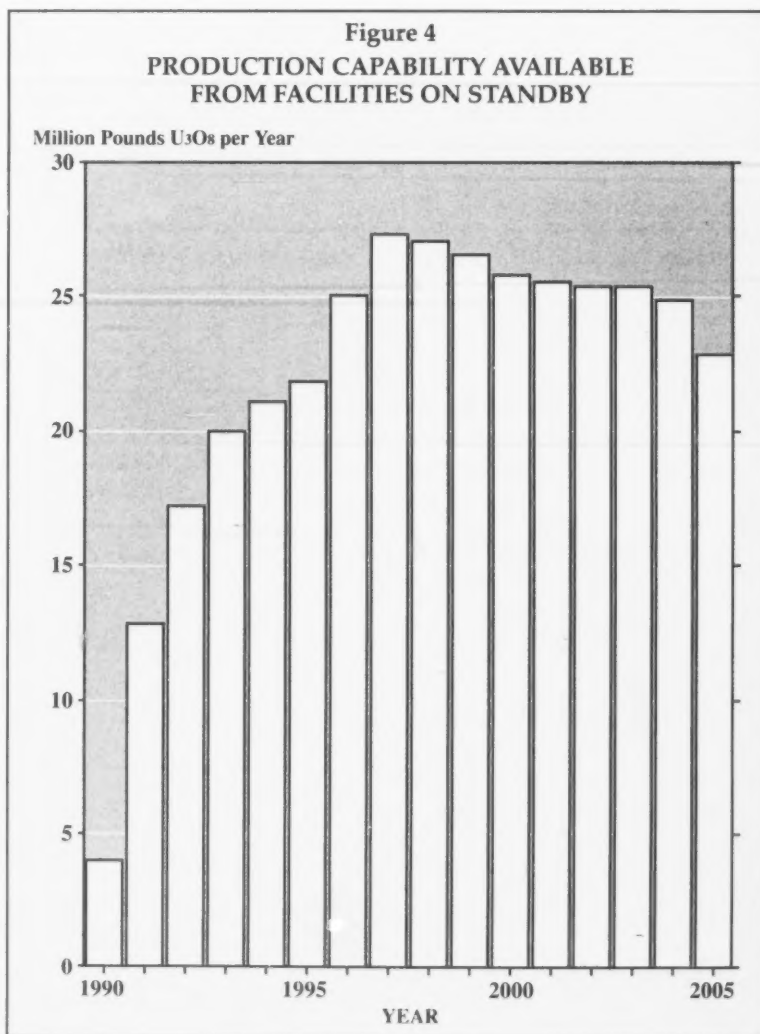
SPEECH

domestic production, and production of its Eastern European satellites, the production from which was totally tributary. Total Eastern European production for this period has been estimated to amount to over 1 billion pounds equivalent U_3O_8 , or about 37 percent of world production.

Australia

Although Australia could account for over 27 percent of total world production, the Australian government's project approval process continues to hinder the development of most of this resource base. This approval process currently centers around the Australian Labor Party (ALP—the party presently in power), and the national conference (which is held every two years). In the 1984 conference, the ALP approved continued operations at Nabarlek, approved expanded production at Ranger, and permitted further development of the Olympic Dam project. The party rejected development of all other uranium deposits. These decisions are the basis of the federal government's "three-mine policy." The policy was never intended to mean that any three mines could operate, but rather, was a three *named* mines policy. The 1986 conference did not readdress the major uranium policy issues. In 1988, however, the ALP agreed to review the current policy through a special committee, which would ultimately put the issues to a ballot of conference delegates, either by mail or at the 1991

Conference. The biennial ALP national conference, originally scheduled for 1990, was delayed until 1991 because of the 1990 elections. While this review opens the door to a change in policy and signals the potential for a commercial orientation of Australia's uranium policy, actual implementation of any substantive changes could be some years away.



SPEECH
China

The China Nuclear Energy Industry Corporation (CNEIC) was established in 1980 by the government of the People's Republic of China (PRC). CNEIC's role is to handle all import and export activities of the China National Nuclear Corporation (CNNC), an organization reporting directly to China's Ministry of Energy Resources.

CNEIC is responsible for all imports and exports of CNNC, including export of nuclear equipment and instruments, technology, services, radioisotopes, chemicals, and other raw or upgraded materials. One of the most

important sectors of CNEIC's activities relates to the export of all forms of uranium used in research and commercial reactors.

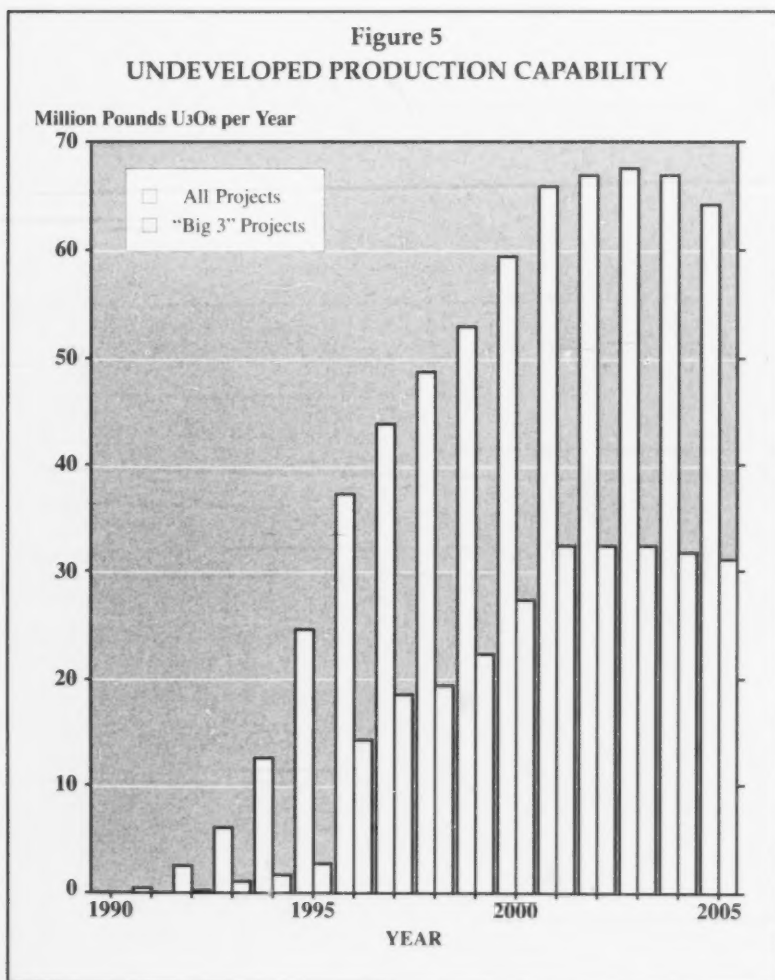
As the sole import and export authority of China's nuclear industry, CNEIC has been involved in the marketing and administration of all uranium and nuclear fuel transactions between the PRC and other countries throughout the world. The Nuclear Fuel Department of CNEIC is very active in Europe, and is playing a major role in the North American nuclear fuel market as well.

The Uranium Market of the 1990s

Through a combination of factors—including large inventories, low production costs, high ore grade, financial strength, and long-term commitments—four entities (Cameco, Cogema, RTZ, and the Soviet Union) are expected to achieve significant market share during the 1990s. National policy and market considerations will dictate whether the Australian producers and the Chinese aggressively enter into this competition. Market share will be achieved through a variety of activities including:

- 1) Continuing production from active projects;
- 2) Restart of projects currently on standby;
- 3) Development of new production from known deposits;
- 4) The discovery and development of new deposits.

TENEX, in contrast to the "Big 3", will fill its major role not through start-up of new projects and acquisitions, but through a balancing of stockpile sales and continuing production.



SPEECH

Historically low market prices (which have persisted for the past several years) have had, and will continue to have, an impact not only on existing operations but also on the development of new production centers, particularly in North America. The result of these low prices is that a number of producers have ceased operation and have placed their production facilities on standby. The combined production capability of facilities on standby is in the range of 30 million pounds equivalent U_3O_8 per year (see **Figure 4**). These facilities will reopen only if reasonable profits can be insured through long-term contracts, or if the projects seem sustainable at spot market prices. Canada, the USA, and South Africa all have substantial capacity that is currently on standby.

Past exploration activities have identified a significant number of potentially profitable uranium deposits that are as yet undeveloped. The production capability of this resource inventory is substantial (**Figure 5**). Cogema, Cameco, and RTZ each have at least two undeveloped projects which contribute to this future capability. However, a significant investment will be required to convert that capability into operating capacity. Historically, that required investment has averaged about \$50 per pound U_3O_8 of annual capacity. **Figure 6** illustrates the investment requirement necessary to develop the new production capacity shown in **Figure 5**.

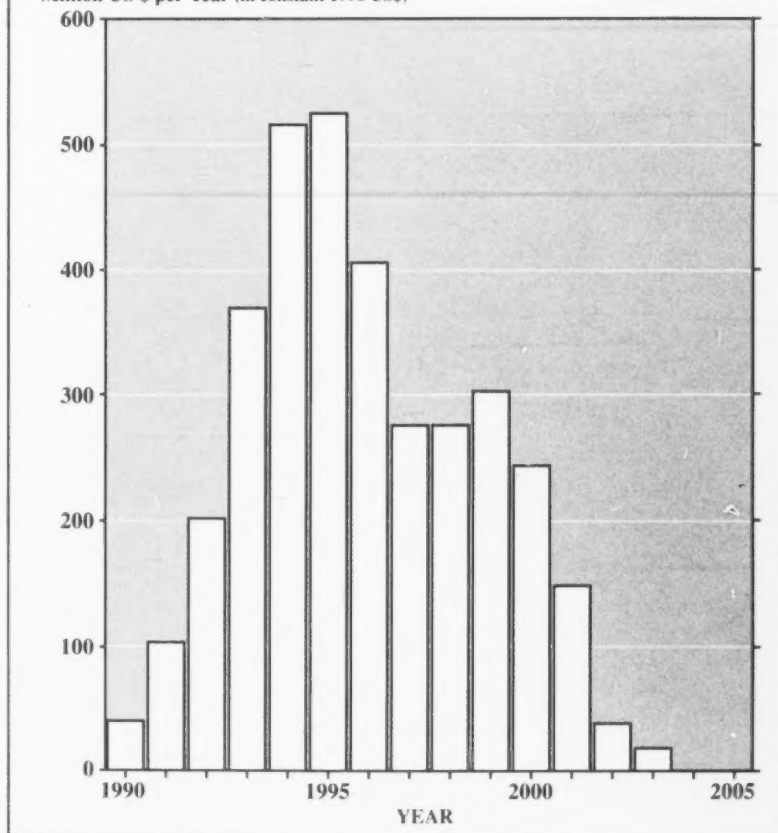
A large portion of this undeveloped production capability exists in Australia where the continuing political debate has stalled most new projects for over 15 years. For this reason, it is unclear on what schedule and to what degree Australian producers

will be able to participate in the market. Collectively, Australian producers have the potential to compete with the "Big 3" if they can overcome the potential hurdles.

Canada also has a large supply of undeveloped, low-cost resources which can play a major role in the 1990s. Unlike Australia, Canada's uranium policy has been very supportive of the industry and has made a substantial contribution to Canada's leading role in uranium production. Price levels will certainly need to show improvement in order for exploration efforts to increase.

Figure 6
CAPITAL INVESTMENT REQUIREMENTS
FOR ADDED PRODUCTION CAPACITY

Million US \$ per Year (in constant 1990 US\$)



Any judgement on the success of such exploration efforts is highly speculative, but, as with all commodities, the uranium industry can be expected to identify major new resources when it is economically motivated. The relative grade, as well as processing methodology, will be the major factors in the development of competitive new reserves.

Conclusion

Although we are in a period of consolidation, we can expect to see several new, non-traditional suppliers enter the market during the 1990s. The most likely candidates

are the Soviet Union, China, and Australia. Other suppliers, such as Czechoslovakia and East Germany, can also be expected to put increasing pressure on western producers as they compete aggressively for market share. It will be interesting to follow the fates of the new "Big 3". Will they hold their market shares, or will other major players emerge? The uranium industry has changed markedly in the past; we think that activity will continue and those companies which have positioned themselves with a variety of low-cost reserves or supplies should be uniquely situated to take advantage of the forthcoming market opportunities. ■

ANALYSIS AND COMMENTARY

NATURAL URANIUM SUPPLY 1990—2005

This article summarizes sections of the Natural Uranium chapter of the 1990 NUEXCO Market Analysis and Price Trend Projections for Nuclear Fuel Materials and Services. It discusses our forecast of uranium production, inventories, and supply capability for 1990–2005. The complete report, available from NUEXCO Information Services, presents a detailed market forecast.

Overview

Given current production capacity, inventory levels, and additional production capability, the supply of natural uranium will be more than adequate to meet expected demand during the forecast period. However, temporary supply-demand imbalances will cause short-term variations in spot market prices.

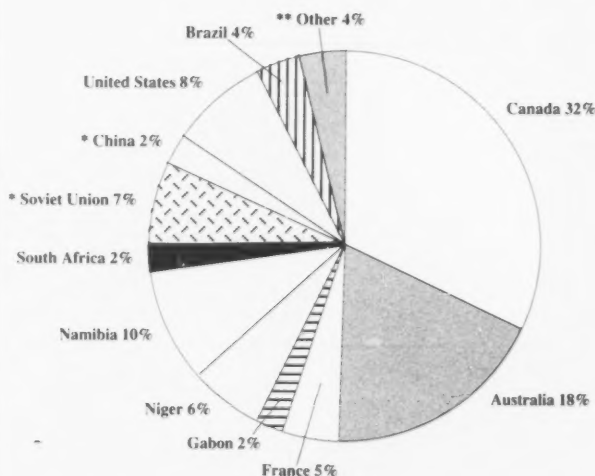
NUEXCO projects cumulative world uranium requirements of 2.2 billion pounds equivalent U_3O_8 during the period 1990–2005. Inventory presently on hand will meet approximately 200 million pounds of those requirements; the balance must come from production. Thus, NUEXCO projects world uranium production will total 2.0 billion pounds equivalent U_3O_8 during the forecast period. Of that amount, 82 percent will come from "specified production" sources; production where the expected source, schedule, and production cost are specifically identified in the forecast. The remaining 18 percent must come from two areas:

- standby capacity that could be restarted;
- capacity that could be added by:
 - expanding existing facilities
 - developing new facilities and deposits.

In order to access the additional material needed to make the supply–demand equation balance, the price must increase enough to

warrant the restart or addition of the new production capacity from what is now potential production capability. Is there enough uranium production capability? Without a doubt. Cumulatively, nearly 800 million pounds of standby capability and projected new capability will be available during the forecast period—more than double the estimated additional production needed. Furthermore, newly defined and discovered resources are projected to contribute an additional 100 million pounds equivalent U_3O_8 to world production capability by 2005. Canada and Australia will account for half of uranium production during 1990–2005 (Figure 1), and exports from the Soviet Union and China will make an increasing contribution to world supply.

Figure 1
TOTAL SPECIFIED PRODUCTION BY COUNTRY
1990–2005



* Expected exports from the Soviet Union and PRC.

** Other countries include Argentina, Belgium, Germany, India, Pakistan, Portugal, Spain, and Yugoslavia.

ANALYSIS AND COMMENTARY**Key Supply Sources****Australia**

The Australian Labor Party (ALP) retained its majority in the March 1990 national elections. This leaves little near-term hope for a revision of Australia's three-mine policy, although the ALP has agreed to reconsider its policy and possibly modify it in the future. The ALP's strict floor-price policy finally succumbed to market forces within the last year; Australian producers may now receive approval from the government to sell uranium at prices that are "at least comparable with those received by others in the market." As some of the obstacles inhibiting competition are overcome, Australia's uranium producers will be able to make an increasing contribution to world supply; total production will exceed 300 million pounds equivalent U₃O₈ during 1990–2005.

Canada

Canada will remain the world's foremost uranium supplier; projected production through 2005 will exceed 500 million pounds equivalent U₃O₈. During 1989 and 1990, Cameco tested its market power as the world's largest uranium producer by:

- limiting its production;
- buying on the spot market to meet some current delivery commitments.

France

After a long period of stability, uranium production in France is beginning to decrease. With market prices consistently below production costs for several years, and generally low-grade ore now being mined, Cogema has announced plans to close its Vendée Mining Division. The Vendée division has been producing about 150–200 MTU per year, but its reserves are becoming very short. France's cumulative production through the year 2005 will fall in the range of 80 to 100 million pounds equivalent U₃O₈.

Production from Gabon and Niger, former French colonies, could total nearly 150 million pounds equivalent U₃O₈ if France continues to subsidize their production. However, by paying higher than market prices, France's willingness to renew its subsidies is subject to periodic internal review.

Southern Africa

Uranium production from South Africa remains burdened by low market prices and apartheid sanctions. As a result, production levels will continue to decline,

possibly to an annual level of one million pounds equivalent U₃O₈ by the mid-1990s.

In contrast, the outlook for Namibia improved when it became independent in March 1990. Sanctions have been lifted and Rössing Uranium Ltd., Namibia's only uranium producer, is expected to boost production to near-capacity levels (10.5 million pounds equivalent U₃O₈ per year).

United States

US facilities will produce nearly 150 million pounds equivalent U₃O₈ during the period 1990–2005. As a result of continued low market prices, production will continue decrease through 1994. US production will rise late in the decade as some new projects start up, but several of these projects have limited reserves, so production will decline once again after 2000 as these reserves are depleted. Significant standby capacity in the USA could be used to take advantage of any price increases. However, large price increases are not expected, so the excess standby capacity can be expected to diminish as facilities deteriorate.

In-situ leaching is expected to account for an increasing share of future US uranium production, and conventional mining production centers may operate only intermittently during the mid-1990s. Only three conventional mills are still operating in the USA—Chevron's Panna Maria, Umetco/Energy Fuels' White Mesa, and Cogema's Shirley Basin.

Other Countries

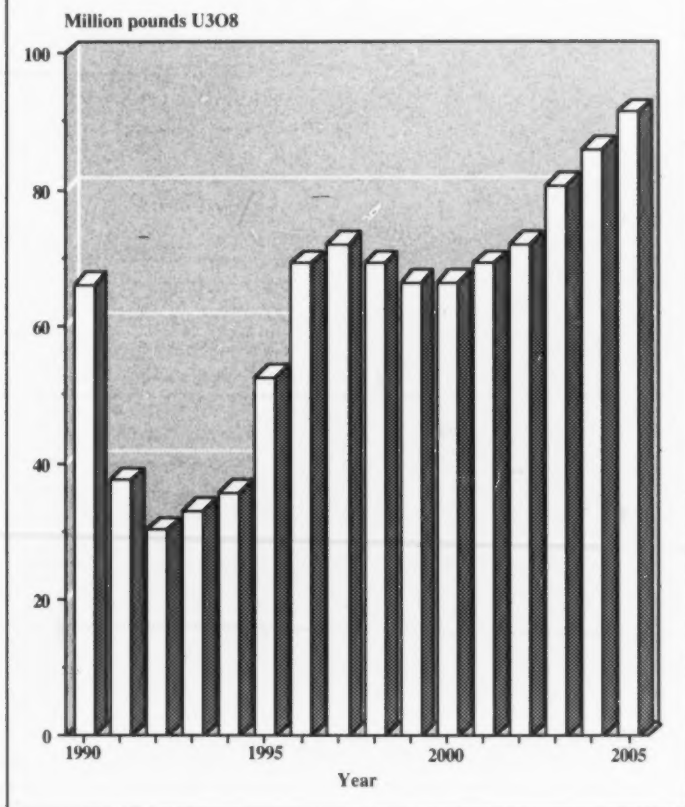
Uranium production from other countries will grow only modestly during this decade, although it could begin to increase faster in the late 1990s. Most of the 125 million pounds equivalent U₃O₈ produced through the year 2005 will be dedicated to internal use. Of this group, only Brazil has enough resources to export significant quantities.

Exports

Uranium exports from countries with centrally-planned economies will account for an increasing share of world uranium supply. Most of the material will come from the Soviet Union and China. The Soviet Union's nuclear power program has slowed appreciably since Chernobyl, but uranium production has not. Some of this production, along with large stockpiles, will be made available to the rest of the world at competitive prices in order to generate much-needed hard currency. The Soviet Union has the capability to export as much as 10 million pounds equivalent U₃O₈ per year, but has been exporting only about 2–3 million pounds. Annual exports could exceed five million pounds by the mid-1990s.

ANALYSIS AND COMMENTARY

Figure 2
FORECAST OF NEW URANIUM DISCOVERIES



China can be expected to offer moderate quantities of uranium into the international market, at least until its own nuclear power program begins to require the material in the latter part of this decade. At current prices however, China has been somewhat reluctant to make aggressive sales efforts.

Exploration and Development

With the decline of uranium prices in the 1980s came a decline in exploration and development expenditures. Based upon historical data, this relationship between uranium prices and exploration expenditures (and subsequent reserve discoveries) is statistically significant and can be used to develop a predictive model. Using a linear regression model of uranium price and exploration expenditures, future expenditures can be predicted. From

that forecast, new uranium discoveries can be projected (**Figure 2**). Because discovery and exploitation of reserves follow years after the related exploration expenditures, a lagging factor has been incorporated into the predictive model that projects additions to currently known production capability. Even with this seven-year time lag, NUEXCO forecasts that 100 million pounds equivalent U₃O₈ could be produced from newly-discovered reserves by 2005.

Inventories

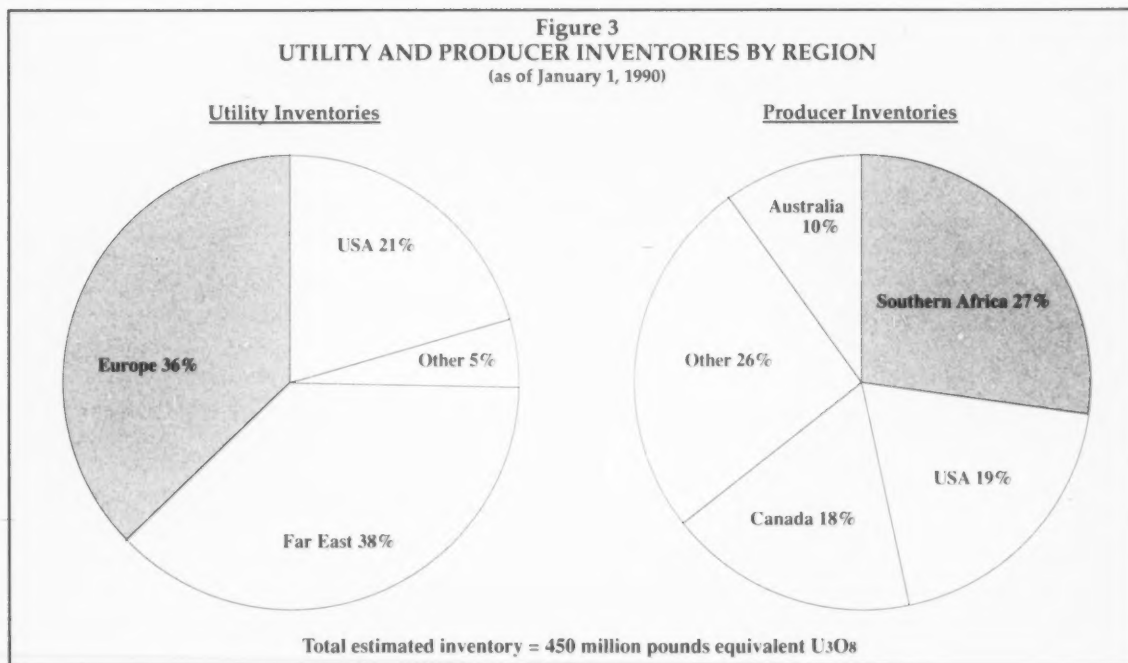
Uranium inventories have frequently been classified as having three separate components:

- **In-Process Inventory**—also referred to as pipeline material or working stock—is uranium at some stage of processing into fuel assemblies.
- **Reserve Inventory**—also called contingency or strategic inventory—is uranium intentionally held over-and-above the in-process inventory, in order to ensure that uranium will always be available when needed. It protects against unexpected delivery interruptions or unanticipated uranium needs.
- **Excess Inventory**—is the amount on hand that exceeds the combination of in-process and reserve inventories.

The classification of inventory into these three categories is not straightforward; definitions can be somewhat fluid, and inventory can be reclassified at any time depending on the perceptions of the market supply situation. If uranium is expected to be plentiful, then reserve inventory is reduced, and vice versa. Historically, the tendency has been to reclassify excess inventory and hold it for the future, rather than to sell it. However, there is a growing tendency, particularly among US and European utilities, to put excess inventory to use, either through loans or sales. So although the absolute level of sales of inventory material may be less than earlier years, the number of entities using market mechanisms such as loans is increasing.

NUEXCO estimates the level of commercial inventories at 450 million pounds equivalent U₃O₈ as of January 1, 1990, about four percent less than one year earlier.

ANALYSIS AND COMMENTARY



NUEXCO's inventory figures indicate the amount of material that could be made available to the market, including any material that could become available by means of a policy decision by a company or government. In-process material is also included, since NUEXCO views the pipeline as a location parameter. Material that NUEXCO judges as strictly strategic and not likely to be consumed by the country's reactors, or be made available for sale, is not included. Of the 450 million pounds, approximately one-third is considered excess, based upon the following reserve inventory requirements by region.

- United States 1 year
- Europe 2 years
- Far East 4 years
- Other Countries 1 year

Reserve inventory policy is subject to many factors, of which, one of the most important is assurance of supply. For instance, the availability of domestic supplies typically allows North American utilities to maintain much lower strategic reserves than utilities in the Far East. **Figure 3** shows the proportion of the world's utility and producer inventories by region.

Supply/Demand Balance

As reviewed in the July Monthly Report (#263 p. 22), NUEXCO projects cumulative uranium requirements of more than 2.2 billion pounds equivalent U₃O₈ during the period 1990-2005. Of those requirements, only 64 percent are presently covered by current inventories or contracts. Therefore, requirements of approximately 800 million pounds equivalent U₃O₈ remain unfilled via contracts. With only 33 percent forward coverage, the USA has the largest unfilled requirements over the forecast period; other regions have substantially higher levels of coverage. (Details of unfilled requirements by country and by company, are included in the complete report.) The market will be particularly active in the USA until excess inventories are drawn down. This equalization of excess supply with demand will occur in 1994-95, although supply will remain ample through the year 2005. ■

NUCLEAR INDUSTRY CALENDAR

Nov. 11-14 *Nuclear Energy Forum* (Washington Hilton, Washington, D.C.).
Sponsored by the USCEA and ANS.
Contact: USCEA Conference Office at 202-293-0770, or ANS Meetings Department at 312-352-6611.

Nov. 12-16 *First Regional Seminar for Europe and the Middle East on Quality Management for Nuclear Power Projects* (Prague, Czechoslovakia). Sponsored by the IAEA.
Contact: Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.

Nov. 12-13 *Fourth World Electricity Conference* (London, England). Sponsored by The Financial Times Ltd.
Contact: Financial Times Conference Organisation; 71-925-2323, Telex: 27347, Fax: 71-925-2125.

1991

Jan. 13-16 *Nuclear Insurance Conference* (The Peabody Orlando Hotel, Orlando, Florida).
Sponsored by the USCEA.
Contact: USCEA Conference Office: 202-293-0770, Telex: 7108249602, Fax: 202-785-4113.

March 24-27 *Fuel Cycle Conference '91* (Sheraton Scottsdale Hotel, Phoenix, Arizona).
Sponsored by the USCEA.
Contact: USCEA Conference Office: 202-293-0770, Telex: 7108249602, Fax: 202-785-4113.

April 14-17 *INFO '91 Conference* (The Westin Hotel, Chicago, Illinois).
Sponsored by the USCEA.
Contact: USCEA Conference Office: 202-293-0770, Telex: 7108249602, Fax: 202-785-4113.

April 14-18 *Third International Conference on Nuclear Fuel Reprocessing & Waste Management* (Sendai, Japan).
Sponsored by the Atomic Energy Society of Japan and the Japan Atomic Industrial Forum,
co-sponsored by the American Nuclear Society and the European Nuclear Society.
Contact: Japan Atomic Industrial Forum at 3-508-2411, or by facsimile at 3-508-2094.

May 13-15 *Second International Conference on Transportation for the Nuclear Industry* (Bournemouth, England).
Contact: Conference Secretary, The Institution of Nuclear Engineers at 081-698 1500.

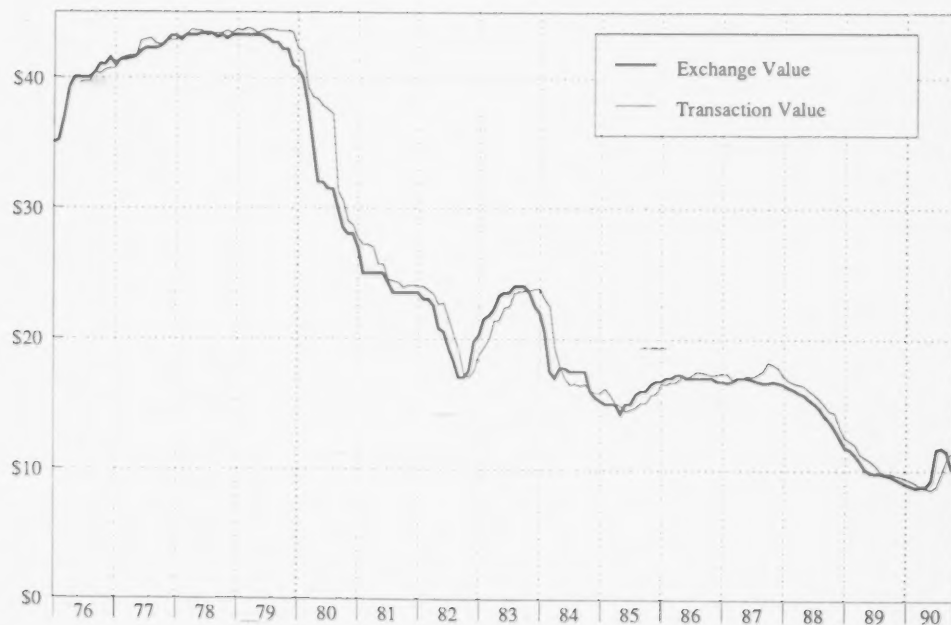
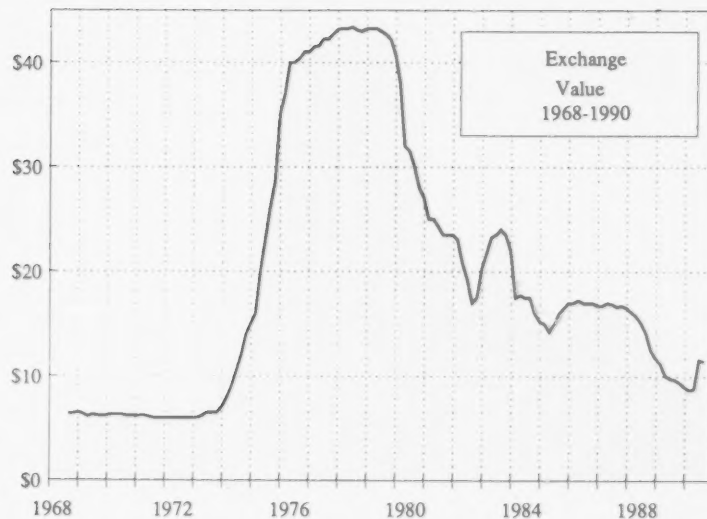
June 23-26 *International Conference on Enrichment* (The Westin Hotel, Washington, D.C.).
Sponsored by the USCEA.
Contact: USCEA Conference Office: 202-293-0770, Telex: 7108249602, Fax: 202-785-4113.

Sept. 22-25 *International Uranium Seminar '91* (The Don Cesar Hotel, St. Petersburg/Tampa, Florida).
Sponsored by the USCEA.
Contact: USCEA Conference Office: 202-293-0770, Telex: 7108249602, Fax: 202-785-4113.

Nov. 10-13 *Nuclear Energy Forum* (Westin St. Francis Hotel, San Francisco, California).
Sponsored by the USCEA.
Contact: USCEA Conference Office: 202-293-0770, Telex: 7108249602, Fax: 202-785-4113.

HISTORICAL MARKET DATA

**NUEXCO Historical
Exchange Value and
Transaction Value**
(In US Dollars per Pound Equivalent U30K)





HISTORICAL MARKET DATA

HISTORICAL MARKET VALUES

EXCHANGE VALUES												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85	8.70	8.80	8.80	9.25	11.60	11.70	11.45	10.10			

US PREMIUM (Relative to the Exchange Value)												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	Discontinued	

HISTORICAL MARKET DATA

UF6 VALUES												
Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90	25.25	24.40	24.40	25.50	32.00	32.50	32.25	29.50			

US UF6 PREMIUM (Relative to the UF6 Value)												
Determined as of the last day of the month indicated (\$US/kg U as UF ₆)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	Discontinued	

TRANSACTION VALUES												
Determined as of the last day of the month indicated (\$US/lb U ₃ O ₈)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25	9.05	8.75	8.65	8.55	8.80	9.75	10.80	11.40			



HISTORICAL MARKET DATA

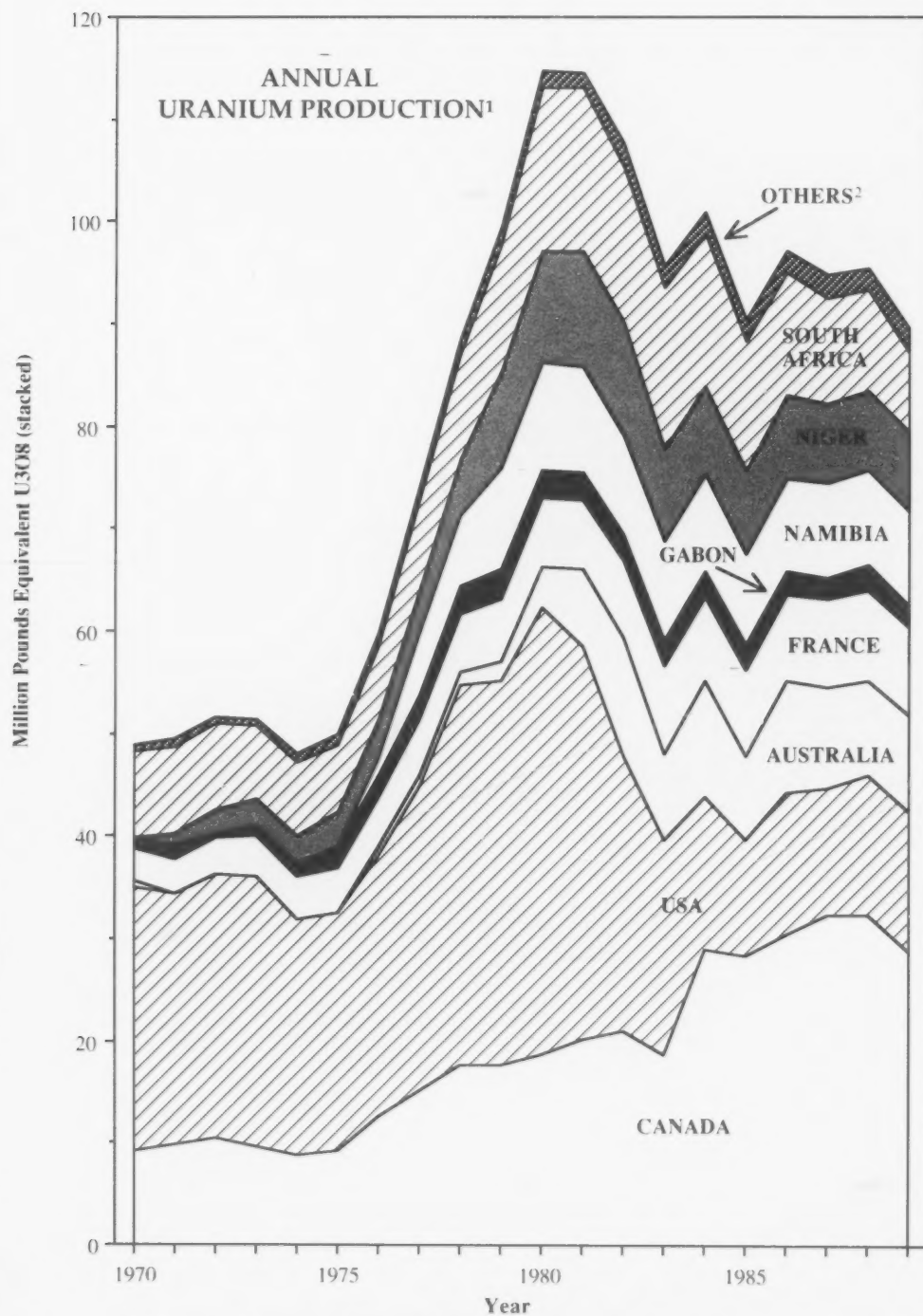
LOAN RATES												
Determined as of the last day of the month indicated (Percent per Annum)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50			

* Float with Prime Rate

CONVERSION VALUES												
Determined as of the last day of the month indicated (\$US/lb U as UF6)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.50	1.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45			

SWU VALUES												
Determined as of the last day of the month indicated (\$US per SWU)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1986	80	80	80	—	80	75	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54	50	50	50	50	50	50	50	50			

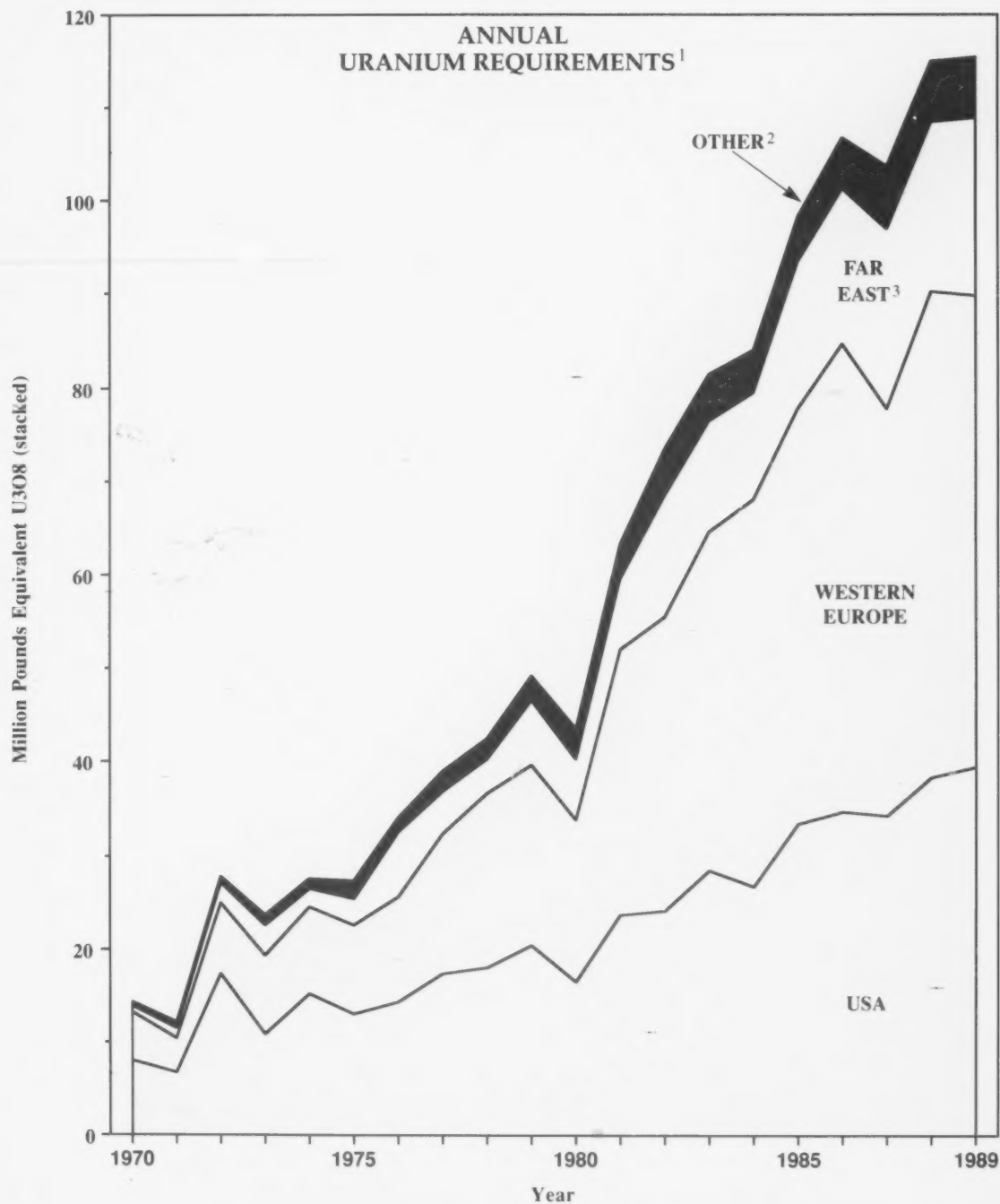
HISTORICAL MARKET DATA



¹ Estimated world production in 1989 totalled 89.6 million pounds (Australia—9.5; Canada—28.7; France—8.5; Gabon—2.2; Namibia—9.2; Niger—7.7; South Africa—7.7; USA—13.7; Others²—2.3).

² Others includes: Argentina, Belgium, Brazil, India, Pakistan, Portugal, Spain, West Germany and Yugoslavia

HISTORICAL MARKET DATA



¹ Calculated by NUEXCO based on actual completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

² Other include: Argentina, Brazil, Canada, India, Mexico, Pakistan and South Africa.

³ Does not include Peoples Republic of China.

GOVERNMENT STATISTICS

AUSTRALIA					
Year	Period ¹	Consumer Price Index ² (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups ³ (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia ⁴ (Australian dollars)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates ⁵ (June 1985=100)
1980	Avg.	95.8	83.1	—	140.8 ⁶
1981	Avg.	105.0	85.9	—	154.1 ⁶
1982	Avg.	116.7	89.0	—	174.9 ⁶
1983	Avg.	128.5	96.9	—	181.9 ⁶
1984	Avg.	133.6	98.0	—	194.4 ⁶
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
1989	Avg.	194.6	117.0	534.65	126.0
Jan	1990	—	119.2	—	128.0
Feb	1990	—	120.8	—	128.0
Mar	1990	204.1	121.5	—	128.2
Apr	1990	—	119.9	—	128.5
May	1990	—	118.9	—	128.7
June	1990	—	116.6	—	—
P = Preliminary R = Revised since last month					
¹ Monthly data for the period 1967 to 1986 appears in Report 233 (January 1988). ² Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 = 100.0). Figures shown at end of quarter represent quarterly average. ³ Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0). ⁴ Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision. ⁵ Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0). ⁶ Base: June 1976 = 100.					

GOVERNMENT STATISTICS

CANADA								
Wage-earner Data: Average Hourly Earnings (C\$) ⁴								
		Industrial Products Price Index: All Commodities ¹ (1986 = 100) ²	Consumer Price Index: All Items (1986 = 100) ³	Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	75.7	67.1	—	—	—	—	—
1981	Avg.	83.4	75.5	—	—	—	—	—
1982	Avg.	89.0	83.7	—	—	—	—	—
1983	Avg.	92.1	88.5	17.22	—	14.18	10.67	11.10
1984	Avg.	96.3	92.3	17.89	—	14.97	11.11	11.68
1985	Avg.	99.0	96.0	18.53	16.48	15.56	11.85	12.12
1986	Avg.	100.0	100.0	19.38	16.70	15.76	12.28	12.58
1987	Avg.	102.4	104.4	20.12	17.15	16.11	12.58	13.20
1988	Avg.	106.9	108.6	20.91	18.51	16.95	13.17	13.77
1989	Avg.	109.4	114.0	21.97	20.02	18.41	13.71	14.16
Jan	1990	108.7	116.9	21.88	20.39	19.03	13.99	14.78
Feb	1990	109.3	117.6	22.51	20.63	19.14	14.49	15.03
Mar	1990	109.2	118.0	22.52	20.75	19.17	14.99	15.07
Apr	1990	109.1	118.1	23.17	21.20	19.46	14.83	14.93
May	1990	109.5	118.7	23.28	20.55	19.01	14.71	15.06
June	1990	109.4	119.2	21.85R	20.63R	18.96R	14.69R	15.05R
July	1990	109.1	119.8	22.49P	20.48P	18.76P	14.49P	15.20P
Aug	1990	109.2	119.8	—	—	—	—	—

P = Preliminary R = Revised since last month

¹ Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

² New Base Year of 1986 as of Report 266. Previous Base Year was 1981. All figures in column recalculated by 0.791 multiplier.

³ New Base Year of 1986 as of Report 264. Previous Base Year was 1981. All figures in column recalculated by 0.755 multiplier.

⁴ Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

GOVERNMENT STATISTICS

SOUTH AFRICA							
		Average Declared Working Costs per Metric Ton of Gold Ore Milled ¹ (Rand)	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled ² (March 1982 = 100)	Consumer Price Index ³ (1985 = 100)	Production Price Index All Groups ⁴ (1985 = 100)	Total Employment in Mining and Quarrying ⁵	Total Salaries and Wages in Mining and Quarrying ⁵ (1,000 Rand)
							Annual Total ⁶
1980	Avg.	35.53	—	51.9	55.2	709,042	2,237,689
1981	Avg.	41.89	—	59.8	62.7	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	71.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	79.0	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	85.6	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	100.0	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	119.5	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	136.2	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	154.1	705,355	7,774,054
1989	Avg.	116.65	273.0	178.2	177.5	700,360	8,833,934
							Monthly Total
Jan	1990	—	—	192.0	188.8	688,837	801,616
Feb	1990	—	—	193.3	190.3	674,026	767,274
Mar	1990	126.74	296.3	196.4	190.9	704,660R	780,614R
Apr	1990	—	—	198.3	194.1	696,107	810,474
May	1990	—	—	200.4	196.3	613,527	719,191
June	1990	128.25	299.87	201.8	197.0	—	—
July	1990	—	—	203.2	197.2	—	—
Aug	1990	—	—	206.5	—	—	—

P = Preliminary **R** = Revised since last month

¹Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.

²Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.

³Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 236.

⁴Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

⁵Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

⁶Annual total is shown, rather than monthly average for indicated year.

GOVERNMENT STATISTICS

UNITED STATES									
		Producer Price Index ¹		Consumer Price Index ²	GNP Implicit Price Deflator ³	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US\$) ⁴			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.7	13.24R	13.26R	12.71R	9.79R
1989	Avg.	111.6	112.2	124.0	126.6	13.59R	13.72R	13.09R	10.05R
Jan	1990	114.1	114.9	127.4	—	13.69R	13.95	13.34R	10.13R
Feb	1990	113.6	114.4	128.0	—	13.70R	13.99R	13.27R	10.16R
Mar	1990	113.2	114.2	128.7	129.7	13.80R	14.04	13.34R	10.17R
Apr	1990	113.2R	114.1R	128.9	—	13.92R	14.30R	13.53R	10.17R
May	1990	113.3	114.5	129.2	—	13.96R	14.16R	13.46R	10.22R
June	1990	113.1	114.2	129.9	130.9	14.00R	14.31R	13.51R	10.27R
July	1990	113.2	114.3	130.4	—	14.18P	14.49P	13.59R	10.34R
Aug	1990	115.9	116.5	131.6	—	—	—	13.56P	10.34P
P = Preliminary R = Revised since last month									
¹ US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233. ² US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233. ³ US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233. ⁴ US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.									

GOVERNMENT STATISTICS

**VOLUME AND PRICE OF URANIUM DELIVERIES
TO THE EUROPEAN COMMUNITY¹**
(Compiled from data published by the Euratom Supply Agency)

Year	Volume of Deliveries to the EC ² (MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts ³ Average Price		Spot Contracts ³ Average Price	
			in ECU per pound U ₃ O ₈	in US Dollars per pound U ₃ O ₈	in ECU per pound U ₃ O ₈	in US Dollars per pound U ₃ O ₈
1977	n/a	n/a	n/a	n/a	n/a	\$41.00
1978	n/a	n/a	n/a	n/a	n/a	\$43.00
1979	10,000	n/a	n/a	n/a	n/a	\$44.50
1980	8,600	n/a	n/a	\$36.00	n/a	\$35.00
1981	13,000	less than 10	n/a	\$33.25	n/a	\$28.00
1982	12,500	less than 10	ECU 32.25	\$32.00	ECU 24.25	\$24.00
1983	13,500	less than 10	ECU 34.75	\$31.00	ECU 26.00	\$23.25
1984	11,000	less than 10	ECU 37.75	\$29.75	ECU 24.50	\$19.25
1985	11,000	11.5	ECU 38.00	\$29.00	ECU 19.50	\$15.00
1986	12,000	9.5	ECU 31.50	\$31.00	ECU 18.00	\$17.75
1987	14,000	17.0	ECU 28.25	\$32.50	ECU 15.00	\$17.25
1988	12,500	4.5	ECU 26.92	\$31.82	ECU 13.65	\$16.13
1989	13,500	11.5	ECU 26.63	\$29.35	ECU 11.04	\$12.19

R = Revised

¹ The twelve European Community member nations are Belgium, Denmark, France, West Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

² The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

³ For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar. Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

GOVERNMENT STATISTICS

US URANIUM MARKETING ACTIVITIES STATISTICS
(Compiled from data published by the US Energy Information Administration) ¹

Year	Total Production (million pounds U ₃ O ₈)	Deliveries to Domestic Utilities From US Suppliers ² (million pounds U ₃ O ₈)	Average Price of Delivered Uranium ² (\$/lb. U ₃ O ₈)	Quantity of Uranium Imported ³ (million pounds U ₃ O ₈)	Average Price of Imported Uranium (\$/lb. U ₃ O ₈)	Quantity of Uranium Exported (million pounds U ₃ O ₈)
1976	25.5	27.6	\$16.10	3.6	n/a	1.2
1977	29.9	27.8	\$19.75	5.6	n/a	4.0
1978	37.0	31.6	\$21.60	5.2	n/a	6.8
1979	37.5	33.0	\$23.85	3.0	n/a	6.2
1980	43.7	35.0	\$28.15	3.6	\$43.10	5.8
1981	38.5	32.6	\$34.65	6.6	\$32.90	4.4
1982	26.9	23.5	\$38.37	17.1	\$25.19	6.2
1983	21.2	24.2	\$38.21	8.2	\$26.16	3.3
1984	14.9	22.5	\$32.65	12.5	\$21.86	2.2
1985	11.3	21.7	\$31.43	11.7	\$20.08	5.3
1986	13.5	18.9	\$30.01	13.5	\$20.07	1.6
1987	13.0	20.8	\$27.37	14.8	\$19.14	1.0
1988	13.1	17.6	\$25.65	15.8	\$19.03	3.3

¹ Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*
1984-1988: Energy Information Administration, *Uranium Industry Annual*

² Data for 1976-1981 includes both domestic utilities and agents

³ Includes imports by domestic utilities and domestic suppliers

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